

The Journal
OF THE
Royal United Service Institution.

VOL. XXVII.

1883.

No. CXXI.

Friday, May 11, 1883.

ADMIRAL LORD ALCESTER, G.C.B., &c., &c., in the Chair.

ON MASTING OF SHIPS-OF-WAR, AND THE NECESSITY
OF STILL EMPLOYING SAIL POWER IN OCEAN-
GOING SHIPS.

By Captain G. H. NOEL, R.N.

INTRODUCTION.

In these days, when steam propulsion has attained such perfection, and is even threatened to be superseded by other motive powers, the question of the masting of ships-of-war may seem to those who claim to keep pace with the advance of science, somewhat out of date and wanting in importance; indeed it is sometimes openly propounded (and that by naval Officers) that masts are useless encumbrances, and ought to be wholly done away with. While admitting that masting should be modernized and rendered more suitable to the present conditions of ships, I am most strongly of opinion that the intention of ignoring such a useful and powerful element of propulsion as the wind is neither scientific nor judicious. My endeavour in writing this paper is to win back some of the wavering to a sounder faith in sail power, by pointing out how, with the modern scientific improvements in material of all sorts, the present system of masting can be rendered very much more efficient and serviceable, and by attempting to show that in ships-of-war, while certain classes can dispense with sail power altogether, to some classes it is useful, and to others indispensable.

Most naval Officers of experience still accredit sail power with a considerable degree of value; but it must be generally admitted that, in these days, when our ships are, on emergency, required to steam at great speed, improvements in the system of masting are urgently needed. Masting should be of such a nature that, while thoroughly serviceable for setting a large area of sail, it can be quickly, easily, and effectively reduced, when the ship is required to steam head to wind, or before going into action.

In treating of the masting of ships, the fleet should be divided into several distinct classes:—

- Class 1. Coast Service Ironclads.
- „ 2. Special Cruisers or Despatch Vessels.
- „ 3. Small swift Vidette Vessels.
- „ 4. Ocean Service Ironclads.
- „ 5. Armoured Cruisers.
- „ 6. Unarmoured Cruisers.
- „ 7. Small Coasting Cruisers.

These seven classes form three groups, between which we cannot draw too strong lines of demarcation, and this not only with reference to their masting, but also to their armament, speed, and many other considerations. It would be a great help to naval architects—who often have reason for complaining that too many good qualities are wanted in one vessel—if these distinctive groups were more fully recognized.

The 1st Group comprises Coast Service Ironclads of all sizes. The 2nd Group consists of Classes 2 and 3, Special Cruisers and Vidette Vessels of the greatest possible speed under steam. The 3rd Group includes Classes 4, 5, and 6, Ocean Service Ironclads and Cruisers, and to this group Class 7 may be here added.

As regards the masting of these Classes. Class 1, Coast Service Ironclads, need no sail power. They are vessels, as their name implies, intended for duty on the coast; they will seldom, if ever, be alone on foreign service, and should never be exposed to the risk of running short of coal. Their one mast is useful for signals and the working of machine-guns from aloft, both necessary matters in action.

Class 2, Special Cruisers, of which the “*Iris*” is a specimen. These vessels, having immense engine power, and possessing the utmost speed possible (for the purpose of carrying despatches or following up and capturing the enemy’s fastest cruisers), are necessarily of fine lines, and their speed under steam is such that square sails will avail them but little. Sail power is only requisite for steadying the ship, and in case of accident to the engines; good fore-and-aft canvas is here sufficient, and flying square sails on the foremast.

Class 3, Swift Vidette or look-out vessels, small craft of about 1,000 tons, possessing the highest speed under steam that is possible, subject to their being thoroughly fit for sea service; these vessels, required as tenders to the ironclad fleet, to move rapidly under steam, discovering and warding off the attack of torpedo boats, and otherwise keeping the look-out, would (like the special cruisers) only require light masting and fore-and-aft canvas.

Class 4, Ocean Service Ironclads, of which the “*Téméraire*” is a fair type, are required to cruise in open water, keeping the sea for long periods, perhaps at some distance from coaling stations, and where colliers cannot always be cleared, even if with the fleet. To this class sail power, though desirable, is not a matter of extreme urgency; their two masts, fully equipped in time of peace, would be useful for cruising purposes, and would serve to keep the men up to those duties so essential to seamen (especially when employed in cruisers where much

will depend on the seamanlike working of sails and spars); whereas, in time of war, the masting will be reduced as much as possible, and all light spars and rigging, used for other purposes, or landed out of the way. In action the lower masts are essential for observation, signals, and machine-gun fire. It may be anticipated that the time will come when this class will be merged in Class 5.

Class 5, Armoured Cruisers, of the "Nelson" or "Warspite" type, required for service on distant stations, where they would be usually unaccompanied. Such vessels are constantly taking long cruizes entirely under sail; indeed their principal duty is cruising when the world is at peace, and the time is of less value than the health and exercise of their crews. In time of war their duty will be to engage the war-vessels of minor States, or the armoured cruisers of a maritime Power, like themselves in build, and also far from their own ports. It will be more than ever necessary to economize coal on these services; the sail power should therefore be most thoroughly efficient, the masting of dimensions suitable for spreading a large area of canvas, and since it is most necessary that when occasions require they should be capable of steaming with great rapidity against the wind, it should be possible to reduce the spars and rigging (offering resistance) quickly and to the utmost extent.

Class 6, Unarmoured Cruisers of 1,500 tons and upwards. Since it is imperative for all such cruisers to have the heels of larger and more powerful vessels in open waters, this class should be even more fully rigged, in proportion to their tonnage, than the armoured heavier cruisers; their speed ought to be materially assisted by sail power, so as to *secure* their escape from a powerful adversary, under steam and sail (in the direction in which the wind would most help them), and to enable them to economize fuel at all times by cruising under sail; for these vessels active and experienced seamen are more than ever wanted, and the smartest possible evolution will be requisite in preparing to steam head to wind for a chase, and in replacing everything for making sail again.

Class 7, Small Coasting Cruisers, of 800 to 1,500 tons, like the larger ships of this type, should be amply rigged. Their principal protection against powerful vessels is the lightness of their draught; speed under steam is not of great moment, but their sail power should be such as to admit of their making good passages from port to port, principally under canvas.

This is a general outline of the requirements of these seven classes of ships-of-war. Masting is considered—in Group I only requisite for signal and machine-gun work; in Group II for steadying the ship, and in case of accidents; and in Group III for spreading a large amount of canvas, which (for this group) is considered essential.

PART I.

Arguments for and against Sail Power.

In dealing with these arguments we shall do well first to accurately ascertain what is being done in our fellow service, the Mercantile

Marine. Through the kindness and courtesy of some of the leading ship-building firms, and owners of the principal lines of steamers, I have been able to collect evidence and opinions on the systems of masting adopted by a considerable number of those companies whose magnificent steamers are unequalled in the mercantile world, and of the possession of which this country may well be proud. The main features of this evidence are as follows:—All the firms agree that sail power is necessary for the purpose of steadying the ships, and in case of accident to the engines, and that masting is useful for taking in and discharging cargo. Five of the principal companies, namely, the "White Star," "Inman," "Royal Mail Steam Packet Company," "Dominion," and "British India" lines are in favour of sail power as assisting the passages of their steamships; other firms are opposed to it, while some remain neutral on the question. The "Guion" Company, the speed of whose new steamers is seldom beaten, and also the "Allan" line across the Atlantic, do not value sail power, nor does the Ocean Steamship Company, though this last send their vessels to distant parts of the world. The "Cunard," "Orient," "National," "Castle," and "Union" lines, and the Pacific Steam Navigation Company admit that sail power has some value; for instance, the "Orient" steamers find the benefit of their sails in southern latitudes, between the Cape and Australia. The vessels of this line are very fully rigged, and those of the other five are serviceably rigged. It is undoubtedly the fact that with steamers of great power and very considerable speed, square sails are of little or no use. The speed these vessels keep up is such that the wind is seldom brought abaft the beam. Hence it is that fore-and-aft sails are those on which they must depend for assistance in steadying the ship, and perhaps in some cases adding to the speed, or at any rate reducing the expenditure of fuel. Some of the older companies still adhere to the three-masted rig, but a great many modern steamers in the Mercantile Marine carry either four or two masts, according to their length. Those of the most improved pattern are pole-masts, often without tops or cross-trees; the yards on the masts forward are in some cases sent down for the part of the passage where head-winds are expected, and in one or two lines they are only intended to be crossed in case of accident to the engines; gaffs are also sometimes dispensed with as holding wind unnecessarily. It will be understood from this statement that every endeavour is made to reduce top hamper and resistance to the wind to a minimum, and yet to show a fair spread of canvas when it is needed. The area of the canvas carried by some of the principal merchant steamers will be found in Table II, page, 15. Except by one or two firms no reduction is anticipated in the present amount of sail power; this question might be affected by the introduction of twin-screws, but apparently there is no idea of departing from the single propeller system of propulsion.

The particulars I have received have principally reference to steamers of full power, intended for mail and passenger service; where the power is not so great, sail becomes of more value, and if it were not for the fact that economy necessitates the keeping down the number of

the crew of such steamers, the spread of canvas would in all probability be still greater. Another element which curtails the sail area in merchant vessels is the variation in the weights of different cargoes. A steamer in light draught is often too unstable to carry canvas with safety, and it is not worth her while to take in ballast to give her the necessary stability. The light draught displacement of a merchant vessel is sometimes only 30 per cent. of that at load or deep draught. The light draught displacement of a ship of war is never less than 80 per cent. of the load displacement, and is usually about 90 per cent.

Comparing the two services, in the Mercantile Marine the one great aim and object (especially with mail steamers) is to make good passages, obtaining the highest speed for the least expense. These vessels keep up the same rate throughout the voyage, sometimes making an average of 360 miles a day, while, with ships-of-war, a long passage at great speed is an exceedingly rare event. Though it is of course necessary to be careful with fuel, there is no risk of merchant steamers running short, as they take in ample to carry them to their destined port or next coaling station; whereas with a ship-of-war, economy of fuel is of the most vital importance, as there is seldom any definite route for her to take, and when least expected she may be ordered off on some special service, where there may be no certainty of obtaining coal. In merchant steamers the crews of seamen are not large enough to effectively work the sails, that is, so as to take every advantage of the wind; on the other hand, the crew of a man-of-war is, or should be, sufficient to work whatever spars and sails she may be provided with, whatever their dimensions. The variations in weights of cargo curtail the power to carry sail in merchant steamers; in a man-of-war this variation is comparatively of little moment.

The conclusions to be drawn from these comparisons are that while the experience of our fellow service is most valuable to us, and many of the improvements in the material and construction of their gear and appliances and the working of their sails may be with benefit introduced into our navy, the general system of masting in the Mercantile Marine is only applicable to our special cruisers, despatch, and vidette vessels, and that we must not be guided by the experience of rapid steamers in deciding on the masting requisite for such of our ships-of-war as are essentially required for cruising purposes, though possessing the power of steaming at considerable speed on an emergency.

Having decided that sail power is not required in Group I; that sails similar to those in the fast steamers of the Mercantile Marine are all that is requisite for Group II; we have now to deal solely with Group III, comprising all classes of armoured and unarmoured sea-going ironclads and cruisers; what are the arguments for and against providing this group with effective sail power?

Firstly, as regards the resistance to the wind offered by masting. The only argument of any weight against sail power is that the spars offer great resistance to the wind when steaming against it. No doubt this resistance is very considerable. The late Mr. W. Froude estimated

that in the "Greyhound," a somewhat fully rigged vessel with wooden masts, and nearly all her rigging of hemp, the resistance offered by the masting was equal to that offered by the hull (that is, to the mid-ship transverse section of the hull above water), about 330 square feet. The introduction of recent improvements in material, together with sending down upper masts and yards, should reduce this number to at most 250 square feet, and the further improvements proposed later on in this paper, to about 200 square feet. The estimated resistance offered by a surface of *one* square foot moving through air at the rate of 1 foot per second is .0017 lbs., and (since resistance varies as the square of the velocity) this would give a resistance of 1 lb. for every square foot moving through the air at the rate of 15 miles an hour. Hence, if the masting of H.M.S. "Greyhound" improved as proposed, and reduced for steaming head to wind, only represented 200 square feet, passing through the air at the rate of 15 knots, she would experience a resistance of only 200 lbs.; this would of course increase rapidly with the rate at which the air passed the ship, until at 80 knots we find the resistance is over $2\frac{1}{2}$ tons. Experiments are very much needed in order to obtain more definite data on the subject of the resistance offered by masting, and it is to be hoped that they will be some day carried out.

The funnels of powerful steamers offer considerable resistance; they serve to shelter the after-masting when steaming head to wind, which lessens to some extent the resistance offered by the main and mizen masts.

Another consideration is, that as at least one lower mast is essential for what are now called military purposes (that is, observations, signals, and machine-gun fire), a certain amount of resistance due to masting has to be overcome, why should not this necessary evil, when under steam alone, be made good use of, when the wind will help, especially if by ingenious appliances you can at will reduce the useful masting, until it offers little more resistance than a mast intended merely for military purposes?

Secondly, on the general duties of cruisers. From the outline already given of these duties it will be understood that cruisers should be capable of making very good passages under steam and sail: either in order to take up their post on a foreign station, to move to any threatened point, or for the purposes of a convoy. Long passages at high rates of speed will be of rare occurrence; of course occasions may arise when it will be necessary to send a ship-of-war or two, or even a squadron, to some distant station where our interests may be threatened; perhaps some unexpected event necessitating a reinforcement. In such a case, if the vessels required are not merely special cruisers, intended for like rapid movements, but something more substantial, the emergency must be met by attaching colliers to the squadron, or if they are not available, by filling the ships themselves with coal, in every hole and corner where it can possibly be stowed. Where judicious precautionary measures are taken, it will be seldom necessary to send ships-of-war to distant stations at great speed, and even if such a necessity should arise it would be no use their appearing

at the place of danger with their bunkers empty (which must result from a long steam passage), and unaccompanied by colliers. In addition to the ordinary duties of cruisers when on their station, will be that of cruising off and guarding neutral coaling ports in time of war, to prevent any of the enemy's vessels entering and obtaining coal; on which service they must be attended by vidette vessels of great speed, for searching out the enemy's ships, and putting their comrades on the scent. As regards convoy duties, ordinary cruisers should be capable of effectively convoying cargo steamers of moderate speed, such as those vessels that bring our food supply, which may require heavily armed protection. Our fast mail steamers will be able to take good care of themselves; and should the enemy send rapid vessels against them, special cruisers must hunt such vessels down: in some cases it will be sufficient if armed merchant steamers of great speed form a convoy for their consorts. For all these duties I maintain that effective sail power is necessary, and that to substitute the weight of the masting for an additional weight of fuel, would in no way render cruisers more serviceable.

Thirdly, on economy of fuel. With respect to cruisers in time of war, this question is of all others the most important. A system by which ships are so masted that coal is economized and sail used is, I am convinced, preferable to the opposite theory of expending coal on all occasions, and meeting this expenditure by making men-of-war their own colliers, to do which you must either construct enormous ships, or, if they are of moderate size, cramp all your internal arrangements and sacrifice the speed of your vessel, when in all likelihood her very existence may depend on that speed when the time of action comes. Increase of coal-carrying power means the cramping of other stowage, reducing the space for the engines and boilers to a minimum, giving the ship an amount of consumable stores which are very inconvenient (detracting from her speed when full, and from her safety when consumed), the stowage or rather the moving of which interferes with the efficiency of the watertight compartments, and after all if coal is to be the sole agent of propulsion, it is impossible for an ocean service ship-of-war to carry sufficient! Where economy of fuel is effected by the use of serviceable sail power great coal-carrying capacity is less important; the same steaming speed ought then to be attained with vessels of more moderate dimensions, and the ship's movements and safety will not depend solely on her ability to obtain coal.

One of the strategical principles in the naval warfare of the future will be starving the enemy out of his coal. Coaling stations will be seized and held, or the coal destroyed. Where then will that vessel be whose only means of propulsion and life comes out of her coal bunkers, when such a mishap occurs to her as to arrive with coal expended at a port coalless, or in the enemy's hands? She will be helpless either to fight or to fly; a well-masted vessel would have good chance of being able to do either one or the other, for with economy her coal would not be short, and even if it were so, her sail would be helpful in supplying the deficiency. Does not the best policy appear

to be so to rig our cruisers that they can take good care of themselves under sail, keeping steam as a reserve, to be used when the enemy is in sight, or for a quick passage where there is a fair certainty of obtaining coal at its end? Captain Colomb, R.N., who I am afraid is one of my opponents on this question, in one paper read at this Institution, April 15th, 1878,¹ proposed the almost entire abolition of sail power; but then in his Prize Essay of the same year he joins our system of communication in war time with no less than 75 coaling stations, 25 of which are not in our possession, and most of the remaining 50 are not fortified or protected in any way. When these important positions are *all* under our flag, and are *all* rendered practically secure from capture or destruction, we may reasonably trust our ships abroad without sail power, though even then it may be often attended with great risk or inconvenience. For instance, a mastless vessel, with just sufficient coal on board to reach her destined port, would not dare attempt the passage, and perhaps might have to retrace her route, or go considerably out of her way to replenish her bunkers; whereas a masted vessel, under similar circumstances, would proceed confidently on her voyage. We sometimes hear it suggested that there would be great economy effected by doing away with masts and sails, and substituting for the weight so saved an extra amount of coal. From Table I it will be seen how little there really is in this suggestion. Of the weight given for the spars and rigging of the "Alexandra," only 186 tons in all, what with the necessary one mast and its top-mast and rigging, tackles, &c., there might be a saving of 120 tons: this, if devoted to coals, would enable the "Alexandra" to steam at full speed for about sixteen hours, or 240 miles.

¹ "Steam-power *versus* Sail-power for Men-of-War." "Journal R.U.S.I.," vol. xxii, No. XCVI.

TABLE I.—*Showing Weights of Coal and Masting on board various ships.*

Ship's Name.	Tons Displacement.	Coal capacity.		Masting.		Approximate weight of a single mast and necessary gear.	Saving which might be applied as fuel.	Distance for which additional fuel would enable ship to steam at full speed.	Remarks.
		Weight.	Fraction of displacement.	Weight.	Fraction of displacement.				
		tons.		tons.		tons.	tons.		
Alexandra ..	9,490	680	·072	186	·02	66	120	{ 16 hours at 15 knots or 240 miles }	{ complement of coal } 500 tons.
Nelson ..	7,630	1,150	·15	175 approx.	·023	60	115	{ 18 hours at 14 knots or 252 miles }	" 540 "
Shannon ..	5,390	560	·104	159	·029	49	110	{ 34 hours at 12 knots or 408 miles }	" 280 "
Inconstant ..	5,780	680	·115	171	·03	61	110	{ 15 hours at 16½ knots or 248 miles }	" 680 "
Bacchante ..	4,130	500 estimated	·12	141	·034	41	170	{ 18 hours at 14 knots or 252 miles }	" 400 "
Canada ..	2,380	470 estimated	·2	82	·034	22	60	{ 25 hours at 13 knots or 325 miles }	" 270 "

In this table expenditure of coal has been taken at 2·24 lbs. per I.H.P., it being a reasonable all round measure with coal obtained abroad.

I contend that if, say, '15 of the displacement is to be devoted to elements of propulsion, it were better to devote '12 to fuel, and '03 to masting, than to have no sail power and '15 of displacement in coals.

Fourthly, on the value of sail power. It will not, perhaps, be out of place here to say a few words on this subject, as the rising generation of naval Officers, who have had little or no practical experience in the sailing of ships, are inclined to doubt the value of sail power. From want of experience a feeling of contempt is growing up for this mode of propulsion, especially in the more scientific school, which includes some of the most promising of our young Officers.

As an instance of the value of sails we have a passage, made in the spring of 1842 by H.M.S. "Vindictive," from off the "Start" to sighting "Java Head," in the Straits of Sunda, a distance by sailing passage of 12,600 miles, in 67 days 15 hours, or an average of 187 miles a day; on 34 days she accomplished over 200 miles' run per day, on 14 days of which, the run was over 250 miles per day, the two best runs being 295 and 296. Sail in this passage may be fairly estimated as having done the work of 500 I.H.P. with the latest improvements in engines, and a probable expenditure of about 800 tons of coal. There are numberless other instances of splendid passages under sail, notably those of the Australian clippers and of the tea-clippers from China, a very good article on which is to be found in "Naval Science," 1873. The management of a ship under sail when making a passage is most truly a science, and by its proper application sail power can be rendered of very great value. Is it because the science of profitably using the wind is being lost in our service that the present age is anxious to prove its ability to do without so powerful a motive agent? Before the days of steam, passages under sail were minutely studied, and with results such as those referred to above. The introduction of steam disturbed the old calculations, at the same time bringing about a laxity in the exceeding watchfulness and care necessary for success in sailing passages, and, either because the merchant service have never made much use of sailing ships with auxiliary engines, or because men-of-war passages are often indefinite in their aim and precision, we do not seem ever to have had the necessary calculations made, or the question of "steam-and-sail" passages thoroughly worked out and studied; though meteorological and hydrographical information is more perfect and concise than it ever was. The result is that our present ships-of-war, though they have steam to help them, often make worse passages than the old sailing ships. I have great faith in the possibility of making most excellent *steam-and-sail* passages; but they will demand, on the part of the Officers, the same constant care and attention that a good sailing passage required (which means that every breath of wind should be taken advantage of), combined with the closest study of wind charts, and the most judicious use of steam.

There is a growing impression that it is impossible for a good sailing vessel to be at the same time a good steamer. Like the question of *steam-and-sail* passages so it is with the construction of man-of-war cruisers—we have not given it a fair trial. No real attempt has been made to combine good sailing with good steaming qualities since

the building of the "Inconstant," which vessel, except for her being somewhat crank, answered both purposes most admirably. The late Mr. William Froude pointed out very forcibly that the form of vessel which offered least resistance, and consequently was best for attaining speed under steam, need not be of great length in proportion to beam, so long as it possessed fine entrance and run. Mr. J. H. Byles brought this subject up only the other day in a paper read at the Institute of Naval Architects, and clearly showed that in the construction of merchant steamers this theory was borne out by practice. I think it has yet to be proved whether on this principle a vessel could not be constructed which would combine steaming and sailing qualities to a higher degree than anything that has yet been produced. There is no doubt that such qualities as good beam and fine ends carry with them every advantage a man-of-war most needs—namely: engine space, coal space, stiffness under canvas, handiness under steam, security of vital parts, and deck-room for working guns and spars. The only difference which appears to me to be requisite in the forms of two ships, one intended only as a steamer, and the other for sailing as well as steaming, is that in the first case it is necessary that her lines should be such as will offer small resistance when on an even keel, and in the second case her lines should have a similar effect, both when on an even keel and when heeling. In the sailing steamer the fineness of the entrance and run would probably have to be worked in more horizontally than vertically, obtaining the same co-efficient of fineness as in the steamship, but giving the vessel greater stiffness under canvas. In armoured vessels the tendency has of late been to increase the beam, and also to dispense with much of the upper weight of armour, such as box-batteries, and armour round the gun-deck: both these tendencies are in favour of a ship's sailing qualities.

In all cruising vessels it will be necessary either to lift or feather the screws; this latter method has lately received the attention of several ingenious engineers, and we may shortly look for its being perfected. Where twin-screw propulsion is adopted lifting the propellers is out of the question.

Fifthly, on the numbers, efficiency, and discipline of the crews.

Since employment can be found for the men there is no reason why the crew of a war-ship should not be sufficiently large to work with ease *any* masts and sails that can possibly be put into her, and that with such effect as to obtain their full value in making a passage. In the present age, when ships are more costly, and consequently fewer than before, there is every reason for keeping the crews up to a high numerical standard. The seamen of the regular service are such a mere handful compared with the numbers of regulars employed in the principal military services of the Continent, that England may well afford to keep that handful up to its full number and efficiency. If we allow seamen and seamanship to fall into disrepute we may construct the most perfect fighting machine the world ever saw, but we shall have no one to fight it. In the days of sailing line-of-battle ships the crews were numerically very strong, in order to work the guns and the sails at the same time. The introduction of steam had the effect of

reducing the crews to the numbers required for working the guns and the engines. Improvements in the method of working the guns caused a still further reduction, and these improvements still developing with the assistance of steam and hydraulic power (which are also employed in nearly all the work of the ship) have advanced until we now find the "Dreadnought," of 10,800 tons displacement, with a complement of only 369 Officers and men. There is no great harm in carrying the reduction in numbers to this minimum in mastless vessels, intended for coast service, to be commissioned when there is a threat of war, and which probably will be only manned periodically (from barracks when we get them) for a few weeks together in peace time for purposes of exercise. But in our ocean service vessels which we *must* keep in employment, prepared for duty or action at the shortest possible notice—sometimes to send a large landing party or a flotilla of boats away, sometimes to organize a torpedo attack or (as in the case of the Sea of Marmora) to put out defences under cover of darkness, against torpedo boats, and to keep the most vigilant look-out, large and well-trained crews are a positive necessity. Complaints are sometimes made that these vessels have not sufficient accommodation for their crews; considering the comparative increase in size, and reduction in the complement of recent ships, there can be no real reason for this, though perhaps in some cases it may be necessary to use forced ventilation, and to berth part of the crew in the compartments below. Under any circumstances it can never truly be said that our ocean-going ships-of-war are not able to carry a sufficient number of men to efficiently work the masting, especially in these days, when improved appliances so greatly facilitate the handling of spars and sails.

At one time the navy of England predominated over the navies of all other nations, because (though our squadrons were often inferior in speed and power to those of the enemy) the crews of our ships were composed of such excellent seamen, and the ships themselves were so admirably handled. Steam has been a marvellous equalizer: any nation, with money to spend on her navy, can now construct or purchase ships-of-war, and claim to hold an important position among the naval armaments of the world. But there is still a strife among maritime nations, in which there will probably be found as much difference between the competitors, when put to the test, as there was in bygone days: that strife is for the mastery in seamanship, pre-eminence in which can only be attained by the most careful and attentive study, combined with experience, and nature's endowment of those seamanlike qualities through which our forefathers so greatly excelled. Seamanship—in the sense of *experienced and masterly knowledge of how to manage a vessel under all conceivable circumstances*—for the Officers, to enable them, with coolness and confidence, to take their ships into action; to manœuvre with precision, to intuitively foresee and frustrate any scheme the enemy may adopt, with judgment and celerity to take the right steps in accident and disaster, to be in fact fully cognizant of all and every duty they may be called upon to perform in the most extreme emergency. Seamanship—in the sense of *intelligent activity and adroitness in the management and manipulation of all matters*

appertaining to a seafaring life—for the seamen, who are more than ever required to be active, cool, and daring, accustomed to danger, steady, and under discipline. All the recent improvements in weapons call for these qualities in the highest attainable degree, and especially since ships under steam at great speed will do small work with their guns and torpedoes, unless those weapons are handled with the utmost smartness, while for service in cruizers, the smartest possible working of sails and spars will be requisite in preparing for an action or a chase. The training of Officers and seamen, so that they may attain true efficiency in the science of seamanship as above described, can only be thoroughly conducted by constant service at sea in masted ships, combined with plenty of boat work, and occasionally a period of practice in the management of a coast service ironclad in cruizes from the port at which she is stationed. The discipline of a ship's company can only be firmly maintained where there is sufficient work to employ the men, and this is best accomplished when a considerable part of the employment is of an evolutionary nature, emulated by competition, requiring a great display of energy, and the strictest and most intelligent attention to orders. Masting, in addition to its value in other respects, is the best means of keeping the men in healthy employment of mind and body, and all the qualities conducive to good discipline.

In the arguments for and against the masting of ocean-going cruizers, which have been treated in this part as fully as the length of the paper will admit, it has been shown that of the two objections to supplying those vessels with sail power, viz., the weight of the masting, and the resistance it offers when steaming head to wind, the first has been proved to be very small when compared with the displacement, and the last is considered capable of being very much reduced by improved appliances. While in favour of masting we have the considerations (provided it is efficient) that sail power economizes fuel, helps the vessel in making a passage, enables small vessels, by augmenting the steaming speed, to escape more powerful adversaries, and it employs Officers and men in such work as will especially develop in them those qualities above all others necessary for managing and fighting their ship—intelligence, vigilance, activity, and discipline.

PART II.

Proposed System of Masting.

In dealing with this part of our subject there are three principal matters for consideration:—

1. The area of canvas it is desirable each class of vessel should carry.
2. How that canvas is best spread.
3. What improvements can be introduced in the means of spreading canvas, so as to render the masting not only efficient for this purpose, but also serviceable for steamships where it is advantageous that the resistance offered to wind by spars and rigging should be reduced to a minimum when occasions require.

First, as regards the area of canvas to be carried. The comparisons between the sail areas in different vessels have been calculated by various methods. We will here adopt the most recent, which is also the method particularly applicable to ships-of-war,¹ that of comparing certain results, the result for any given ship being obtained by dividing the area of plain sail in square feet by the displacement to the power of two-thirds, or $\frac{A}{(D)^{\frac{2}{3}}}$, a method intended to put the sail area of all vessels nearly on an equal footing, whatever their displacement. With reference to merchant vessels this formula is not so suitable, as their sail power cannot be fairly calculated in its relation to deep draught displacement, and yet there is no other means of effecting a comparison with ships-of-war, if this enormous and uncertain measure be not taken. Hence, the number representing the sail power of a merchant steamer is very small as compared with that of a man-of-war. See the following Tables, II and III.

¹ Mr. W. H. White, in his *Manual of "Naval Architecture,"* chap. xii, on Sail Propulsion, gives a great deal of valuable information on this subject.

TABLE II.—Area of Sail, &c., of some of the principal Steamships of the Mercantile Marine.

Company.	Name of Ship.	Tonnage.		Area of Plain Sail. A	Area of Sail (Displacement) $\frac{A}{3}$ or $\frac{A}{D^{\frac{2}{3}}}$	No. of Masts.		Remarks.
		Gross.	Load Displacement. D			Total.	No. square rigged.	
		tons.	tons.	sq. ft.				
White Star Line ..	Britannic ..	5,004	3,600	19,527	43.3	4	3	
Inman Line ..	City of Berlin ..	5,494	9,850	20,224	44.0	3	3	
Dominion Line ..	Vancouver ..	4,841	9,712	17,795	39.0	4	2	
British India Line..	Dacca ..	3,908	4,500	15,282	56.0*	2	2	* Load displacement should probably be greater, and consequently this No. less.
Guion Line..	Alaska ..	6,932	11,465	22,295	43.7	4	2	
Allan Line ..	Parisian..	5,359	9,600	15,244	34.0	4	2	
Orient Line ..	Austral ..	5,588	about 10,000	28,092†	60.4	4	2	† This probably includes stay sail.
Cunard Line ..	Servia ..	7,332	12,600	about 17,700	32.5	3	2	
National Line ..	Egypt ..	4,669	9,500	about 18,000	{ about 40.0	4	2	
Union Line..	Athenian ..	3,877	6,425	18,958	55.0	3	1	Area of sail probably includes stay sails.
Pacific S. Nav. Co.	Iberia ..	4,666	{ about 9,000	13,185	30.04	3	2	

TABLE III.—Area of Sail, &c., of the undermentioned Ships-of-War.

Class.	Name.	Tons Displacement.	Area of Plain Sail.	$\frac{A}{D^2}$	Rig.	Remarks on sailing qualities.
Sea-going ironclads ..	Alexandra ..	9,492	22,960	51.21	barque	sails fairly.
	Hercules ..	8,392	25,800	68.65	ship	sails well.
	Téméraire ..	8,464	24,920	59.65	brig	sails fairly.
	Triumph ..	6,640	22,752	64.26	barque	sails well.
Armoured cruisers ..	Nelson ..	7,566	24,766	64.26	"	sails fairly.
	Warspite ..	7,390	20,575	54.23	brig	not complete.
	Shannon ..	5,405	21,580	70.07	barque	sails fairly.
	Inconstant ..	5,782	26,034	80.81	ship	sails very well.
Unarmoured cruisers, recent and new ..	Bacchante ..	4,130	18,805	73.05	"	sails well.
	Active ..	3,090	16,593	78.38	"	"
	Calypso ..	2,765	16,580	84.16	barque	not complete.
	Canada ..	2,383	14,152	81.34	"	Sails fairly.
Special cruisers ..	Opal ..	2,144	13,106	78.8	ship	sails well, but too crank.
	Caroline ..	1,420	10,610	84.0	barque	not complete.
	Cormorant ..	1,124	9,942	91.97	"	sails well.
	Iris ..	3,735	12,857	53.82	barquentine	"
Steam frigates ..	Arethusa ..	3,748	14,307	69.3	"	not complete.
	Immortalité (1861) ..	3,690	25,640	107.37	ship	sails very well indeed.
	Rinaldo (1861) ..	1,200	12,630	111.85	"	sails very well.
	Ganges (1852), 84 guns ..	3,594	27,734	117.93	"	"
Sailing liner ..	Pœton (1849), 50 guns ..	2,680	24,267	127.36	"	sailed very well indeed.
	Vindictive (1842), 50 guns ..	2,585	24,595	130.58	"	"
	Vestal (1849), 28 guns ..	1,080	14,372	140.91	"	"
	frigate ..	465	9,989	166.43	brig	"
China clipper ..	Espérance (1844), 12 guns ..	1,970	17,520	110	ship	"
	Thermopylæ (1868) ..	..	..	..	..	very well indeed.

TABLE IV.—*Proposed Area of Sails for different classes of Ships-of-War.*

Group and Class. (<i>Vide</i> page 544.)	Description of Ship.	Tons Displacement. D.	Area of Plain Sail. A.	$\frac{A}{D^2}$.	Rig.	Remarks.
Group I. Class 1 ..	Coast Service Ironclads	tons. 10,000 to 5,000	sq. ft. —	—	1. (Military).	
Class 2 ..	Special Cruisers	3,500	10,000	43.5	Barquentine.	
Group II. { Class 2 ..	" "	2,500	8,000	44 {	3-masted top-sail Schooner.	
Class 3 ..	Vidette Vessels..	1,000	5,000	50	Top-sail Schooner.	
Class 4 ..	Seagoing Ironclads	8,000	22,000	55	Brig.	
Class 5 ..	Armoured Cruisers	7,000	25,000	68	Barque.	
Class 5 ..	" "	5,000	20,500	75	"	
Group III. { Class 6 ..	Unarmoured Cruisers ..	3,500	19,500	85	Ship.	
Class 6 ..	" "	2,500	16,400	90	"	
Class 6 ..	" "	1,500	12,700	95	Barque.	
Class 7 ..	Small Coasting Cruisers	1,000	10,000	100	"	

Table II gives the comparisons of the area of plain sail for mail and passenger steamers by the method described $\left(\frac{A}{D^{\frac{2}{3}}}\right)$; it will be seen from this table that the sail power of the largest steamers of the Mercantile Marine averages about 40, and those of more moderate size about 50. Table III gives the relative sail power of present and past ships-of-war, showing how much the power has of late years been decreased; this is a necessity in very large vessels, and may be partly on account of the superior fineness of the lines in the smaller vessels. Table IV shows the proposed area of canvas and the rig for the different descriptions of vessels, as classed in the introduction to this paper; it is principally compiled from the two preceding tables, and it will be seen that while coast service ironclads carry no sail, special cruisers only carry fore-and-aft canvas, and a light square rig forward, whereas sea-going ironclads carry much the same sail as the "Téméraire" and "Warspite," and armoured and other cruisers have a slight increase on the present vessels of their displacements.

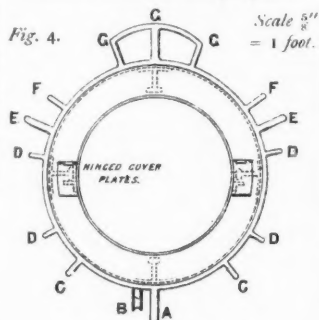
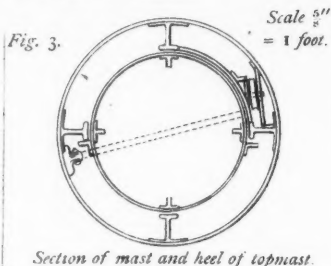
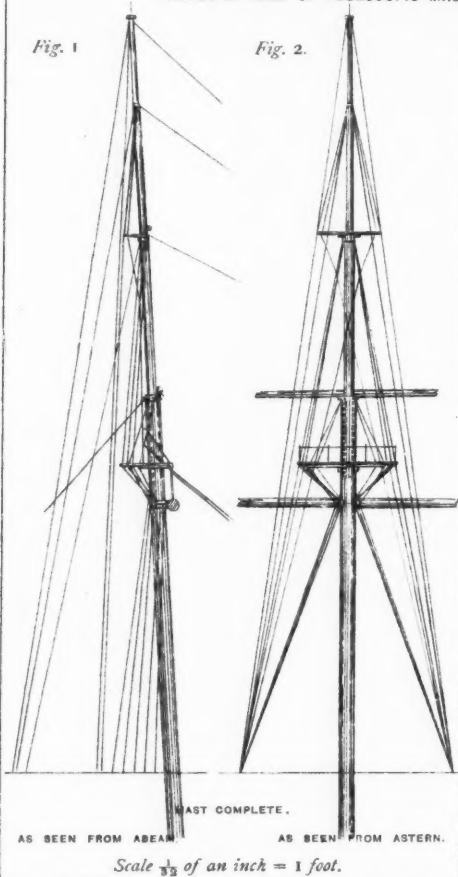
Secondly, as to what is the best method of spreading the canvas. In the actual manner of setting a ship's sails, little improvement has been made since the taunt, tapering masts, and square yards of the end of the last century (for his great attention to the efficiency of which the then Sir John Jervis obtained much deserved credit). Of late years some minor alterations have been attempted in the setting of sails (such as patent reefed top-sails), but have obtained no permanent hold in the Royal Navy, where there are plenty of hands to work ordinary sails. Double top-sail-yards (and even top-gallant-yards) have been introduced largely into the sailing merchant shipping, an admirable invention, where the weight and resistance of spars are of comparatively little consequence, especially for short-handed vessels.

In the navy, though improvement in material is much wanted, there is small need for alteration in the general arrangements for setting sail; we may therefore decide that for our ocean-going cruisers masts and yards giving a similar means of spreading canvas to those in the last of the wooden frigates and smaller vessels, is still required; a lesson may, however, be learnt from the clipper ships, and greater squareness given to the upper yards, especially to the top-gallant-yard, which (I suppose for purposes of evolution) have always been short, spreading a very small top-gallant-sail, as compared to the sailing ships of the merchant service. Top-gallant studding sails can be dispensed with in large vessels, but would still be useful in the smaller classes; top-mast studding sails are indispensable for good passage where single top-sails are used (which must necessarily be somewhat narrow), and, having the booms, of course lower studding sails can be set. For special cruisers, barquentine rig, and for the smaller vessels of this class two or three masted top-sail schooner rig, or something corresponding to the masting of the mail and passenger steamers of the Mercantile Marine, is very suitable.

Thirdly, with respect to the actual construction of masts and yards, the plan on which they should be rigged and worked, and the gear for handling sails.



Diagram 1.
PROPOSED PLAN OF TELESCOPIC MAST AND PLAN OF RIGGING.



REFERENCE TO FITTINGS AT MAIN MASTHEAD.

A. Cap backstay.
B. Mizzen topmast stay.
CC. Lower buntlines.
DDDD. Top span and ladder.
EE. Lower lifts.
FF. Topsail clew lines.
GGG. Topsail-yard rest and span for hanging it (when topmast is housed).

Diagram 5.
SHOWING MAIN LOWER MAST OF H

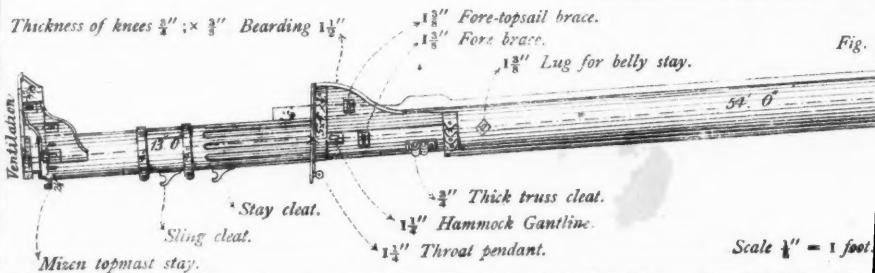
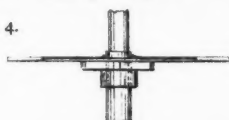


Diagram 2.
PROPOSED PLAN OF TOP AND CROSSTREES
FOR TELESCOPIC MAST.

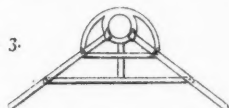
Scale $\frac{1}{8}'' = 1$ foot.

Fig. 4.



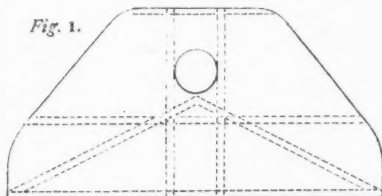
Crosstrees in elevation from aft.

Fig. 3.



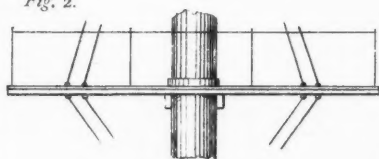
Crosstrees in plan.

Fig. 1.



Top in plan

Fig. 2.



Top in elevation from aft.

Diagram 5.
MAIN MAST OF H.M.S. "CALYPSO."

Fig. 1. Elevation.

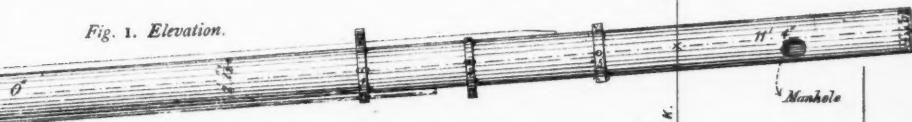
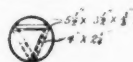


Fig. 2. Section.



Scale $\frac{1}{4}'' = 1$ foot.

Diagram 3.
PROPOSED PLAN OF TRUSS FOR LOWER YARD.

Section of yard and
elevation of mast
and saddle for
lower yard.

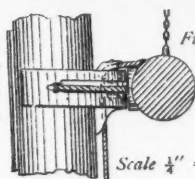


Fig. 1.

Scale $\frac{1}{4}'' = 1$ foot.



Section of mast, with
plan of saddle and
lower yard.

Fig. 2.

Scale $\frac{1}{4}'' = 1$ foot.

SHOWING THE MAST FROM FORWARD.
THE TOPMAST HOUSED. TOPSAIL-YARD
IN POSITION READY FOR BRACING UP.

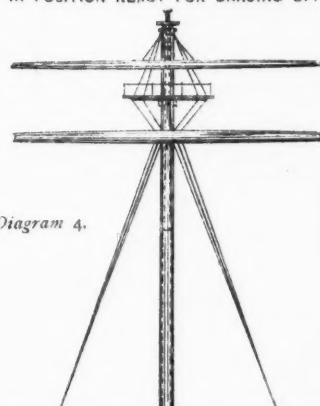


Diagram 4.

Scale $\frac{1}{12}'' = 1$ foot.

See Diagram 1.

Improvements in the equipment of our ships have of late years been gradually effected; for instance, steel is now used in the construction of the lower masts; steel wire rigging and lower and top-sail lifts are fitted; gaffs work on traveller guides on the masts, instead of on try-sail masts, and blocks with iron straps inside the wood are substituted for larger and more clumsy wooden blocks. These improvements are all in the right direction, though they were late in coming, and many of them emanated from the Constructor's department more with a view to reducing the weight to be carried, than to the efficiency of the rig for sailing and steaming purposes, attention to which is essentially the business of naval Officers. Further improvements are still necessary in order to render masting thoroughly efficient for spreading a large area of canvas, at the same time being lighter in construction so as to hold less wind, and also to enable the surface of masting (offering resistance) to be reduced at will, as quickly and as effectively as possible. This must be done by a further use of steel, in masts, and their tops and crosstrees, the use of steel wire in all standing rigging, and even in running rigging in such parts as are of the nature of pendants, or are not man-handled or belayed; by reducing the number of the shrouds, and by facilitating the methods of sending down or housing upper masts and yards, and pointing lower and top-sail-yards more nearly into the fore-and-aft line. With this general idea in view, I have endeavoured to work out in detail the manner in which improvements may best be accomplished in these matters with the following results. The main features of the alterations proposed are—(1) that the masts be telescopic, the top-mast, top-gallant-mast, and perhaps the royal-pole, being all in one, constructed of steel, and housing into the lower mast until only the truck shows above the mast-head; (2) that the standing rigging throughout be of flexible steel wire, fitted as is afterwards explained, admitting of a reduction in the number of the shrouds and backstays; (3) that a cap-backstay amidships be fitted to the fore and main lower masts supporting them from abaft, and enabling the two after-shrouds on each side to be dispensed with, and the remainder of the lower rigging (taken to bolts in the lower masts) to be placed somewhat lower down on the mast-head than it is at present; (4) that the lower yard be fitted with a special truss arrangement, so that it may be braced nearer into the fore-and-aft line, when the top-mast is housed, and consequently the top-mast backstays are out of the way of bracing the yards, and that the top-sail-yard be fitted to hang to a span from the lower mast-head when the upper masts are housed.

Diagrams 1 to 4 (Plate XV) are intended to illustrate the proposed plan. The masts and spars here depicted represent the main-mast of a ship such as the "Calypso," of about 2,765 tons. Diagram 5 is an enlarged drawing of the actual plans of that ship's main-mast. Fig. 1 shows the proposed mast with upper mast fidded, and rigging complete. In this drawing the royal-pole is shown as part of the top-mast and top-gallant-mast, all being in one; this might be desirable in a ship depending to a great extent on her sail power, but would probably be dispensed with in larger types of vessels, where flying royals set on poles triced up

abait all, and secured aloft, might be used instead when required. The lower mast here represented is of about equal strength and weight to that now in course of construction—by Messrs. Edward Finch & Co., of Chepstow, to whom I am indebted for a great deal of useful information—for the main-mast of H.M.S. "Calypso"; both masts are identical in diameter and thickness of material, namely, $\frac{3}{8}$ inch Siemens' steel plates, and $24\frac{1}{2}$ inches outside diameter; there is an addition of 3 feet in the length of the proposed lower mast, but the whole height of the truck is about the same. The "Calypso's" mast is stiffened by three tee-bars, $5\frac{1}{2}$ inches \times $3\frac{1}{2}$ inches \times $\frac{3}{8}$ inch, running up the whole length inside, and the mast is further strengthened by cross-bars (as shown in section, Diagram 5, Fig. 2), at short intervals apart. The proposed mast obtains an equal strength by substituting for these stiffeners and crossbars, four (instead of three) bulb tee-bar stiffeners, which admit of a sufficient space into which a top-mast of the same diameter as that of the "Calypso," namely, 17 inches, may be housed, the top-mast being steadied by the bulbs of the steel bars, and being guided by two angle-bars on the lower part of the top-mast resting against the side-stiffener, as shown in diagram, Diagram 1, Fig. 3, the top-mast pendant, or heel-rope, working inside the lower mast over a sheave, as also shown here. The top-mast, top-gallant-mast, and perhaps royal-pole, might be constructed in one if made of steel, which material—according to Messrs. Finch & Co.'s estimate—would give the same strength for even less weight than wood. Perhaps this would not be the case if the mast was of small diameter, as with hollow tubes of the same weight per foot (or area of section) the greater the diameter the greater the strength to resist bending strains, limited only by the plates being too thin to support local strains. But we may fairly consider that with a reduced weight of crosstree, and the absence of a top-mast cap, the masts above the lower mast would not exceed the weight they are at present. The diameter proposed is quite sufficient to admit of the top-mast being made of wood, and there is no particular reason why it should not be so constructed with the top-gallant-mast in one spar. The objection to a steel top-mast is the possibility of its being crippled unless carefully handled, and the awkwardness of dealing with it if it is damaged. Against this we have greater strength, and the fact that the part where most of the strain will come when the ship is rolling, namely, that part which emerges from the lower mast-head, is greatly supported by good fitting, no tube being able to bend where it cannot bulge at the sides; so that, after all, the liability to crippling is not very great. A spare mast should be carried, and, if necessary to shift the mast, it must be hoisted out above all, using for the purpose a good spar secured to the lower mast-head and standing well above it. In housing the mast and sending it up again, it is proposed to take the breast backstay on each side to *one drum* (probably amidships on the main-deck), fitted with a break and winch, so that it can be hove in or veered at pleasure; and so by keeping equal strain on the backstays—greater or less according to the rolling of the ship—the mast can be moved up or down, well supported throughout the evolution.

The top, crosstrees, and tressletrees, as shown in Diagram 2, Figs. 1 and 2, are constructed as lightly as possible, of box or tee-bar steel boarded over, or fitted with gratings. The top is similar in plan to ordinary tops; it is supported by light steel wire spans above and below, so as to be independent of the support usually supplied by stout wood crosstrees and the futtock shrouds. The top-mast crosstrees, also of steel, form a small stand with two arms stretching out, one on each quarter, as outriggers for the rigging; a bar joining the two giving additional support, and more room for the men to work. On the underneath side there is a box taking the place of the tressletree, and serving as a rest for the crosstrees when lowered on to the lower mast-head, the top-mast being housed; in this box the top-sail tye sheaves would be fitted to take the place of hanging blocks; the rigging and backstays would be secured to a strong band round the upper part immediately under the crosstrees; the outriggers could be fitted to work on swivels, so as to hang down abaft all when the mast is housed, being hung by light steel pendants from the top-gallant funnel.

The yards proposed would in all cases be similar to those at present in use, made of wood (there being no particular advantage in constructing them of steel); the lower yard, as shown in Diagram 3, is fitted with a plan of truss which I believe will prove very suitable for all lower yards in place of the clumsy chain trusses so universally condemned in the navy, and the patent trusses of the merchant service. It consists of two standing steel wire "rolling pendants," secured to bolts on the side of the mast, taken round the fore part (of the mast) and set up to bolts on the opposite quarters of the yard; these pendants prevent any athwartship movement without in the least impeding the bracing up of the yard, in doing which one pendant winds round the fore part of the saddle, and the other unwinds: they are made to work in a groove so as not to slip off; the "saddle" is a broad steel eccentric ring (standing out from the fore part of the mast and well supported from it by stays), against which the lower yard rests under ordinary circumstances. The yard is kept in position against the saddle by a centre "truss pendant," secured to a bolt on the upper part of the after side of the yard in its centre; the pendant passes through a nine-pin block (which has horizontal turning action), and down the fore part of the mast, being worked by a small purchase: this pendant will have to be eased slightly when the yard is braced forward, and set taut when the brace is belayed.

As regards the rigging, Diagram 1 shows the mast as rigged complete, Fig. 1 a view from a beam (the port rigging being omitted to prevent confusion), and Fig. 2 from abaft. It is proposed that all standing rigging should be of flexible steel wire rope, the strength of which is shown in Table V. A 4-inch cap backstay is the only real innovation; it is intended to support the mast directly from aft, and to take the fore-and-aft strain, which would otherwise be carried by the two after shrouds on each side, which are here dispensed with, the remaining side supports consisting of five $3\frac{1}{2}$ -inch shrouds instead of seven 3-inch as in the "Canada"; the rigging is closer together (being thus less in the way of masking guns) and lower down on the mast-head, so as to allow

the lower yard to brace well forward. The cap backstay being in the way of an ordinary gaff, a monkey-gaff would have to be substituted, setting a good storm sail, and being down on deck, instead of holding wind when the sail is not set. The top-mast rigging differs from that at present fitted, as it is intended to be set up on deck (or between decks); it passes over the top-rim (where it would be clamped), using the top as an outrigger, and is brought through the eccentric ring forming the saddle of the lower yard, over rollers down as much abaft the mast as possible, to drums or some appliance for setting it up; there are three $2\frac{1}{2}$ -inch shrouds a side, instead of four $2\frac{1}{4}$ -inch (as in the "Canada"); the backstays are, as usual, one after and one breast backstay each side, of $2\frac{1}{2}$ inches (these would be out of the way of gunfire when the top-mast was housed); the breast backstays would be fitted to work on a drum (as already explained), in order to steady the top-mast while in the act of being lowered or hoisted. The upper rigging is somewhat similar to that usually fitted, only very much smaller than hemp rope, and the number slightly reduced; top-gallant, $1\frac{1}{2}$ -inch steel, two backstays and one shroud; royal, two 1-inch backstays; stays for all masts in number and strength as at present. The top-mast pendant, or heel rope, two parts of 4-inch steel rope, rove in the usual manner through the heel of the top-mast, but working inside the lower mast, would be taken down to the main-deck, and there brought to a capstan or winch (probably worked by steam); the top-mast would be fidded above the top. All parts of the running rigging—such as lifts, braces, sheets, clew-lines, reef-tackles, ties, yard-ropes, &c.—which do not reach the deck, would be of flexible steel wire, of the same strength as hemp, tailed with hemp rope for working, all the wire being rove through small iron-bound blocks, thus saving a great deal of the space, or surface, which at present offers resistance to the wind.

There are two natures of flexible steel wire rope now used in the navy, that known as "Bullivant's," where the wires in the strands are laid up the opposite way to the strands themselves (like ordinary hemp rope), and "Lang's," where the lay of the wires is in the same direction as the lay of the strands; both are of about equal strength, and will work over a sheave as easily as hemp rope of similar strength. Lang's rope is less liable to kink, and for this reason it is preferred for ropes that have to be worked. Table V gives the strength of flexible steel wire rope, and compares the smaller kinds with hemp rope of same breaking test.

TABLE V.—*Breaking Test of Flexible Steel Wire Rope.*

Size of steel rope.	Breaking test.	Remarks.	Corresponding size of hemp rope.	Size of steel rope.	Breaking test.	Remarks.	Corresponding size of hemp rope.	Size of steel rope.	Breaking test.	Remarks.
inches.	tons.	broke at	inches.	inches.	tons.	broke at	inches.	inches.	tons.	
$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{4}$ ton.	1	3	17	20 tons.	8	$6\frac{1}{2}$	98	
1	$1\frac{1}{4}$	$2\frac{1}{4}$ tons.	$2\frac{1}{2}$	$3\frac{1}{4}$	20	—	9	7	113	
$1\frac{1}{2}$	$2\frac{3}{8}$	4 "	3	$3\frac{1}{2}$	24	27 "	10	$7\frac{1}{2}$	130	
$1\frac{1}{2}$	4	—	4	4	31	—	11	8	148	
$1\frac{3}{4}$	$5\frac{1}{2}$	—	$4\frac{1}{2}$	$4\frac{1}{2}$	39	—	12	9	180	
2	7	—	5	5	59	75 "	—	10	220	
$2\frac{1}{4}$	9	19 tons.	6	$5\frac{1}{2}$	71	—	—	11	270	
$2\frac{1}{2}$	$11\frac{1}{2}$	21 "	7	6	84	—	—	12	320	

Preparing a ship—fitted with telescopic masts as proposed—for action, or a steam chase to windward, the upper yards would be sent down, the parrel of the top-sail-yards cast off, and the yards lowered before all, and hung to the steel wire span from the mast-head; the top-mast would then be unfitted and lowered into the lower mast, until almost out of sight, the crosstrees resting on the mast-head, and the top-gallant funnel above it again; the crosstree outriggers would be doubled down abaft out of the way, all top-mast and upper rigging and backstays being unsnatched from the top and crosstrees taken down abaft the lower mast, and stopped in, so as to offer no additional resistance; the lower and top-sail yards would then be braced nearly fore-and-aft. Sending the masts up again the operation would be reversed. Under favourable circumstances a well-trained crew should complete either evolution in less than fifteen minutes, care being taken to stay the masts before sending the yards across, a comparatively easy matter, if the top-mast rigging is taken to drums worked by a winch.

A great many of the suggested alterations might be carried out in ships as at present masted; for instance, the further introduction of steel wire in standing rigging, the use of steel wire in running rigging, the proposed truss arrangement (so long as it was not intended to house a top-mast at sea), the cap backstay, &c.—all such improvements would tend in the right direction towards making spars suitable for vessels requiring steam as well as sail power.

I do not unreservedly advocate telescopic masting; the idea is an old one, though it has not yet been tried, principally because the materials for its construction and working were unsuitable, but now that steel, and steel wire, can be used for these purposes, that difficulty is overcome. The advantages claimed for telescopic masts are, that it is the only feasible plan of housing a top-mast at sea; that the top-mast and top-gallant-mast once housed are out of the way, instead of lumbering the decks—so housed they might possibly prevent the lower mast from falling if severely wounded in action; and, lastly, the top-mast being housed, and consequently its backstays out of the way, the lower yard can be braced nearly fore-and-aft, and the courses can be set with advantage whenever they will stand. I am sorry that I have not been able to obtain a model from which to explain the working more clearly, but at the last I found myself too pushed for time. There is a model in the Greenwich Museum of a plan for a telescopic mast submitted by the Officers of the Portsmouth Dockyard in 1864; but the lower mast is very large, and the top-mast and top-gallant-mast (in one) is very small, both matters which can be improved by the use of better material.

In conclusion, I trust that I have not altogether failed in attaining the object I had in view in preparing this paper, namely, of winning naval Officers back to a sounder faith in sail power. Perhaps I have not satisfied some of those gentlemen who so kindly supplied me with information on the subject of masting the steamships of the Mercantile Marine, but as a matter of fact I fully concur in the general principles on which those steamers are masted; no merchant vessel is required for cruising purposes, so it is unreasonable to suppose that their owners

will put cruising masts into steam vessels. With ships-of-war it is different; our principal ironclads, which for the safety of our country should never be sent out of European waters, and those armoured vessels intended only for the protection of the Colonial ports at which they are stationed, may well be mastless; but all other ships required for ocean cruising should be well and effectively provided with sail power as an auxiliary to their steam. I am most firmly convinced that any departure from this policy would, in case of a long and severe war, prove most disastrous. I have therefore endeavoured to show that, by judicious modification, masting may be still rendered of very great value, and that sail power should not be considered a dead letter.

Captain P. H. COLOMB, R.N.: My Lord, Ladies, and Gentlemen,—As I have been in some sort challenged by the lecturer in his paper, and as I had the honour to read a paper here on the same subject some time back, I thought it might be convenient to the meeting if I were, so to speak, to open the ball by giving what will be possibly considered somewhat of an opposite view. It is very difficult indeed to discuss a paper of this nature, which, besides dealing with such very important subjects, is such a strong paper. There is no question that the lecturer has taken up a very strong position, and that he is not very eligible to attack. It would be impossible to do it at all were it not for the admirable system which the Institution has adopted of printing the paper beforehand and circulating it, so that we may have the opportunity of thinking over the matter which the lecturer is about to bring forward. I shall be glad to define my position with regard to this question, so that there may be no mistake. I believe that wind-force every day pales before the advance of steam; I believe that in considering the fitting of our ships-of-war we must look to fighting power first of all; I believe that full rig for any steamer burns more and not less coal, besides greatly encumbering her locomotive powers; but I favour any rig which turns out to be a true auxiliary, which does not interfere in any way with the ship's fighting power, which only assists locomotion and economizes coal. I do not believe in a navy arranged to develop a particular class of men. I believe that the British seaman has altered in my time very greatly; I believe he will alter in the time of our successors much more; but I believe he will be still the British seaman, although of a totally different kind—that is to say, that he will be superior, when it comes to fighting, to the seaman of any other nation. Captain Noel says that the wind is “a useful and a powerful element of propulsion.” I say, “useful,” certainly; “powerful,” no; for the simple reason that in ordinary service you always have as much wind against you as you have in your favour. He goes on to admit that “improvements in the system of masting are urgently needed.” When I came to that passage I bethought me of Balak, the son of Zippor, and I considered that whereas the lecturer had been sent to curse me, he had altogether blessed me; for after all, the whole of my contention heretofore has been for this improvement in the rig which the lecturer tells us is “so urgently needed.” He goes on to say that “a long passage at great speed is an exceedingly rare event.” Quite so—in peace time—although my experience does not go quite so far. I am not going to take upon myself, and I suspect very few naval Officers would, and the lecturer, when he comes to take a cool view of it, will not be able to lay it down, that in war time long distances at great speed must not be undertaken by our ships. But our gallant Chairman himself possibly has in his recollection an incident which happened in the Mediterranean, where certainly the passages are not long, but where an urgent necessity required that a ship should proceed at her full speed 600 miles, and it so happened that the only ship which was available, although the whole Mediterranean fleet were with her at Malta, and under similar conditions to herself, was a mastless ironclad. I think that the resistance of rigging in proceeding under steam is very much under-estimated. In my paper I took it at

5 per cent.; I suppose that the coal cost 5 per cent. by the resistance of the rigging and the spars. I believe it to be considerably more. Of course experiments are necessary. We have not got them; I wish we had; but I believe the friction of ropes, and the vacuum formed behind each of them increasing the pressure on the fore side, are elements which make their retarding power very much greater than is generally understood. We should all be struck with this fact, that in the Mediterranean, during the Dulcigno business, where the masted ships were lying in smooth water, land-locked in a very heavy gale with terrific squalls, most of the ships present had their lower yards and topmasts struck: some of them had three anchors down, and some dragged their anchors. The single mastless ironclad—the “Thunderer”—was lying the whole time at single anchor with her buoy well out on the starboard beam, and she never even approached the tautening of her cable. I am quite sure Lord Alcester will recollect that; and although it was not entirely due to the absence of masts and rigging, I cannot help putting some of it down to that absence, and I am borne out in that by what happened to the “Inflexible” not very long ago, where, being masted and having the same anchors—the Martin anchors—as the “Thunderer,” she, not in anything like the same weather, dragged those anchors. That is one of the things which make me think that the resistance is under-estimated. The lecturer gives us to understand that the single mast for machine-gun firing is an absolute necessity. I am a little doubtful about that. Of course we are so using it; I presume we are bound to use it now. We are furnishing the mast-heads of our ironclads with considerable structures for the purpose of carrying machine-guns. What I am afraid of is that, as in the “Huascar,” those structures may become, more or less, slaughter-houses, inasmuch as they will certainly draw the fire of the machine-guns upon them, offering such an extraordinary mark, and the men being so crowded together that what misses one will hit another. The lecturer goes on to speak of “cruisers” and “cruizing,” and I am afraid he and I, and all of us, more or less, are misled by the old meaning of the word “cruizer.” A cruiser in old times was always in motion, but the orders she got were seldom such as to dictate motion. She was generally to maintain a position on a given spot, and it has always struck me that this “cruizing” in war time would now simply be going and lying on a particular spot, and remaining on that spot a given time, as closely as possible; and I venture to think that taking a fully-masted ship and an unmasted ship of the same coal capacity, the unmasted ship would probably have more coal in her bunkers after a given time of such “cruizing” than the fully-masted ship, because the one would be blown off her station while the other would not. The lecturer also speaks of “convoys,” and he certainly uses the term “steam-convoy.” But he does not seem to carry in his mind what steam-convoys mean. I cannot avoid thinking that steam-convoys will proceed at some considerable speed, and I feel that most of our ships, being fully rigged, would not be able to keep up that speed which was necessary for the ordinary steam-convoy. We come then to the question of coal endurance. I have taken two ships. I do not mean to say that they offer any argument, but they are simply illustrations to give us matter round which our minds may circulate. I take the “Comus,” which with 440 tons of coal could keep up a speed of $13\frac{1}{2}$ knots for six days, or 1,950 knots; or a speed of 10 knots for thirteen days, or 3,120 knots. Now I pass to the “Hecla.” She can take a great deal more than this, but suppose she can take in 2,000 tons of coal. She will go 10 knots sixty-nine days, or 16,000 miles; and if you come to cruising at low speeds, or using low speeds only, she will go $6\frac{1}{2}$ knots 166 days, that is to say, 26,000 miles, and it looks very much as if the “Hecla” might coal at the beginning of a war and not positively have used the whole of the coal when the war was over! There is a strong feeling at present as to the collier tender, and the lecturer is very firm as to putting your coal outside the ship rather than inside. I think his argument is identical with what used to be urged before the days of steam line-of-battle ships. We all recollect how strong the feeling was in those days, that we ought to build more paddle-wheel steamers, the object being that they should attend the sailing line-of-battle ships, and should tow them in and out of action; and it was a considerable time before the service frankly gave itself over to putting the paddle steamers inside the line-of-battle ships instead of outside. I cannot help thinking that condition of things will be also brought about with

reference to the steam collier. The lecturer has laid great stress upon the difficulties of stowage of coal. Now I do not see that there is any such difficulty. You have to make the ships longer. The practical question is to get speed, and to do that you must have length, and small beam in comparison. Doing that, you can always get sufficient coal supply. The lecturer draws a comparison between the case of a sail-masted ship out of coal, and the case of a steamer without masts, possibly without coal also. But supposing the other steamer has coal; what possible hopes can a sailing vessel without coal have of winning any action against a steamer with coal? In Table No. 1, he leaves out the retardation, and also the question of stores and accessories, which must follow masting, and I think, therefore, that table must be somewhat modified in order to be applied in practice. But then I think all the real power of sail can be got with very much less weight. Coming to sailing passages, I do not think it is quite fair to take a special case. As a fact we know that the speed of sailing passages is exceedingly small, except in those cases where ships are built specially for particular runs, and can make use of a fair wind, first one way and then the other. The present steam war-ships, we are told, sometimes make worse passages than the old sailing ships. I am afraid that is the case, but it is because we are allowing the steam and sail to fight a battle in the ship without either of them being permitted to gain the victory. The lecturer has laid it down that the crews ought to be sufficient to work masts and sails. I am not quite prepared to say that they ought not to be sufficient to work the masts and sails; I only say that, by some occult process, that is not now the case—the tendency is the other way. We have in a ship of 3,500 tons, for instance, a complement of 691, and we only have 336 seamen; in another ship of 7,600 tons, with a complement of 576, we have 283 seamen; in another smaller ship of 5,400 tons, with a complement of 452, we have 243 seamen only; in another, essentially a sailing ship, of 4,100 tons, with a complement of 407, we have only 174 seamen; and it gets worse as you go on, because in more modern ships still, of 7,400 tons, with a complement of 436, you only have 158 seamen; so that, in spite of us, the numbers are being reduced, and I cannot see how we are to increase them. One of the difficulties, no doubt, is the difficulty of finding space for them, of which the lecturer speaks so lightly. I wish he were Captain of the Steam Reserve for a little time to correct that view. But, as a matter of fact, the condition of our war-ships is such that whatever else we might want to do, we cannot find the time with an ordinary crew to properly work the masts and sails. I am sure there is no one in the service, at any rate of those who have had the honour, and I may say the pleasure, of serving under the gallant Chairman, who will doubt that he is a man more likely than any other to make full use of every appliance which is under his control in that way, and he must know that in the Mediterranean squadron it was, as a rule, a difficulty to get that amount of training and drill aloft which was generally considered desirable. Either the wind was ahead, or the passage had to be made at a certain speed and we could not wait. There was one occasion certainly when we got a bit of fair wind, and the masted ships turned the unhappy mastless ship away about her business, but in the end she came in with a great deal more fuel than those who had started so gaily with a fair wind. The lecturer, speaking of seamanship, tells us that in cruisers the smallest possible working of sails and spars will be requisite for preparing for action or chase. What I am afraid of is, with the existing rig this "preparing for action or chase" would mean a general pitching overboard of the spars, because I am assured that any "chase" will go straight in the wind's eye. They will certainly never take the other line. Then we have a subject adverted to by the lecturer which we cannot yet get rid of, namely, that sail work is a necessity in the training of Officers and men as to discipline. I continually think to myself, "Is this true?" I cannot make up my mind about it; but whenever I see, as I saw the other day, a parade of eighteen or twenty blue-jackets, hard at work with batteries and electric cables and Whitehead torpedoes and galvanometers, and a variety of appliances which were utterly beyond me, requiring the most delicate handling and careful watching, any mistake meaning the destruction of the ship, supposing the torpedoes had been filled, I could not help thinking, Are these men the better for having been royal yardsmen?—supposing they ever had been. I do not dogmatize,

but I cannot help asking myself the question. Of course it is impossible for us to look at this change which is going on in the service with easy minds. We cannot help thinking, "Dear me! the days of our powers, and our display before the world as a navy, are disappearing!" As the lecturer says, "steam is equalizing things." I do not think myself that it is; I believe that we are going to take the lead in steam just as before in sail; but the point of the matter is this, that these changes will take place unless we are duly prepared to hang those inventors who bring forward new weapons which are not asked for! If we had hung Dr. Gatling, and Mr. Whitehead, and Mr. Nordenfolt, we should not be in these troubles now, and until we are prepared to take that sort of action, I am afraid the thing will change in spite of ourselves. I ought to be much more side by side with the lecturer when I come to the second part of his paper, because he is proposing a modification of the rig, and that is my point. I want to see the rig so altered as to give a real efficient help to the ship without in the slightest degree encumbering her, and although I must say I like a great many parts of his proposals, I do not like them as a whole. The lecturer does not seem to have been quite clear upon the point, that were you to rig a ship in this way the only sail which is really of use to the ship will be the double reef topsails and the reef topfore-sail—that is to say, giving the proportion of area which he gives to the plain sail. I want to give a greater area of strong sail and to reduce the area of light sail as much as possible. Then all these appliances for easing the working of the sails tell against that process which you want to keep for the training of your men. If you make the process very easy the men get none of the training which they are now getting, for essentially that training is the overcoming of the difficulties which at present exist. The lecturer says we do not need these alterations and appliances in our own navy. Certainly not, because if we did we should lose the drill and training which we are told we want. When I read my paper, I was pretty strong upon the question of the mastless ships, but I had not then commanded a mastless ship. My impression is, that if any person had gone through my experience, first commanded a masted ironclad, and then a mastless ironclad, his instincts in favour of the mastless ship would have been so immensely aroused, that it would be almost impossible for him to argue fairly on the question, and I grant that very possibly my experience prevents me from arguing quite fairly on the question; but still I cannot help thinking that what we want to do in our war-ships is to become utterly independent of the elements. They are not to be coaxed: they are to be mastered. You must draw their teeth and pare their claws, and when you are thoroughly masters of them, then you may play with them—if you like!

Admiral Boys: My Lord and Gentlemen,—If it had been a custom of this Institution to second any resolution, or to second a paper, in spite of what my friend Captain Colomb has said, I should have been very happy to have seconded Captain Noel's paper. My opinion has always been that sail power in certain descriptions of war-vessels is indispensable. He has very clearly divided his ships into classes and groups. I will touch shortly upon each class as numbered. No. 1, "Coast service ironclads," I agree with Captain Noel. No. 2, "Special cruisers, or despatch vessels," I do not altogether agree with, for the same reason that Captain Colomb has given. I draw a conclusion directly contrary to him with regard to having no masts at all. These are cruisers of the "Iris" type, and their special duty is chasing; Captain Colomb implies that chasing is always to be in the wind's eye. I differ from that because it must depend upon where you discover your chase. If you discover her to leeward, or in the vicinity of land, you will of course not let her cross you to get to windward of you, and the addition of sail power may in that case enable you to catch her, when without it you would lose her. I will instance what happened in the case of the old "Warrior." When first commissioned her full steaming power was from 13 to 14 knots, but she actually, for some consecutive hours, running free with a strong breeze with all plain sail set, made 17½ knots, and if that had been in chase, those additional 3 or 4 knots would have been the means of attaining the very object required. Class 3, "Swift vidette vessels."—Yes. With regard to ironclads of the "Téméraire" class, Class 4, I quite agree with what Captain Noel says. It happened to be my duty

to be sent out in the "Devastation" on her first cruise to the Mediterranean. The "Hercules" was to accompany us. We started one evening from Portsmouth to go to Plymouth, with a nice easterly breeze steaming easily 8 or 9 knots. The next morning the "Hercules" made a signal that her cylinder was cracked and she could not steam any longer. She made sail, and kept her station alongside of us all the way to Plymouth. Now if she had not had those masts she would have been a helpless log, and could not have moved without assistance: that is one instance in which the sails of the ocean service ironclads actually did come into play. On the subject of machine gun fire from one mast it is generally accepted that machine-gun fire must be kept under by machine-gun fire, as Captain Colomb says, and I think the machine-gun in the top has a great advantage over the machine-gun on the deck. There is another purpose, which has not been mentioned, for which the one mast becomes a necessity, viz., to hoist in and out heavy weights, especially torpedo boats, which amount to 12 or 13 tons. Class 5.—I quite concur. Class 6.—Yes. Captain Noel says, in regard to Class 7, that small coasting cruisers of 800 to 1,500 tons should be amply rigged. In that opinion I do not agree. I think these vessels, being only coasting cruisers, and never far from a port, will always be able to renew their coals. They are not intended to make long passages. The lecturer goes on to "arguments for and against sail power," and he adduces the system and practice of various lines of ocean steamers. I do not think any satisfactory conclusion can be drawn from the action of these mercantile steamers with regard to sail power, for the reason that they start from their port, and go on for hours and days, and perhaps weeks, without any alteration in speed. Their engines are constructed for this purpose, whereas most men know that in a man-of-war, especially in fleet manœuvres, with the exception of the flag-ship, the alteration in the amount of revolutions and speed is something interminable, and for that reason I do not think we can make a comparison between what is done in men-of-war and merchant vessels. With regard to the resistance of the wind to masted ships, Captain Noel's figures come to this, that in the "Greyhound," in a calm, going 15 knots, one man power exerted more by the engines would compensate for the resistance of the air. I do not think that is very material, and with regard to the remark about the resistance offered by masts going head to the wind, and the assistance of sail when we are making a fair wind of it, it comes to this, that when we are going head to the wind, we reduce our mast to almost nothing, but when we are making use of the wind we expand the power of the masts a hundredfold, or more, by setting sail wherever it will draw. With regard to steaming and sailing qualities combined, my impression of Mr. Froude's experiment is that it was only at low speed that the proportion of breadth to length did not interfere much with the speed. At high speed I believe it really does, and I do not think that Mr. Froude's experiment ever warranted the same conclusion as to very high speed. Certainly our Mercantile Marine Constructors do not think so, for they have increased the length of their ships to ten or twelve times their width, and thus obtain their great speed. With regard to the "numbers, efficiency, and discipline of crews," of late years the tendency has been to reduce crews to a minimum. I believe it has principally been done at the suggestion of the Constructor's department, the great object being to save weight, as every additional man increases the weight to be carried, not only in himself but in the bag, hammock, &c., required for him. I think crews have been reduced a great deal too much. We can never send our ships cruising all over the world to destroy an enemy's ships, like the "Alabama" did, because we should have to send prizes to a Prize Court for adjudication, and to put prize crews into them for the purpose, and where the crews are so very small we could not possibly do it. I think we *must* increase our crews. I recollect some years ago I was appointed to the command of the "Pelorus," a ship once commanded by our noble Chairman; we were starting for China, and were ordered to take out thirty supernumeraries. I did not want to be troubled with them, with their hammocks and baggage; however, they were sent. We stowed them away somewhere or other, and when they had shaken down, we were very glad to have them. I think there is too much complaint made of not having room to put the men in our ships. We must increase the crews and let them find room, and

depend upon it they will do so. With regard to Captain Noel's proposed rig and bracing up yards, we have learnt one lesson, that we must be cautious how we allow the yards to brace too readily fore and aft. One of the supposed causes of the upset of the "Captain" was the topsail yards flying fore and aft in the squall, on account of the tripod masts, and they had not power to brace the yards in again to get the sail off. That was adduced as one cause—bracing up too sharp. In my opinion, as long as we have a navy that depends upon coal as the means of propulsion, it will be a monstrous waste not to make use of that universal and costless power, the wind, and we must not forget the old ditty that "when the wind blows then the ship goes."

Captain HARRIS, R.N.: My Lord, Ladies, and Gentlemen,—Long ago, when I read Captain Colomb's very valuable paper, in 1878 I think, on *Sails v. Steam*, I fancied he had gone rather too far in condemning sails, but now I agree with every word of it; indeed I go so far as to think that his paper of 1878 is appropriate to the present time, and that Captain Noel's paper would be more appropriate to that period. I believe that masts and sails, in most cases, are only an encumbrance, and waste of time and power. Still I cannot help regretting them; and I confess to enjoying, as much as anybody, the glorious feeling of bounding over the waves, under the influence of sail power alone; still the common-sense view must be taken, and delightful as those feelings are we must put them on one side. Steam is gradually and relentlessly driving everything before it, and masts and sails will have to go too. However, I think we all ought to be exceedingly thankful to Captain Noel for putting the matter in such a very good light. In this way we are able to judge very fairly of the respective merits of steam and sail; we have had the matter most ably advocated on both sides. I am glad to find that Captain Noel seems to be quite of one mind with Captain Colomb as to the uselessness of masts and sails for actually fighting armourclads; in point of fact, when he treats of ironclads of the "Téméraire" class, he there also seems a little doubtful whether masts and sails are a matter of great moment; but when he comes to actual cruisers, then he makes a great point of it. Now whenever I see a cruiser heavily masted and rigged, the story at once occurs to me of the old woman who was selling apples on a common during a very windy day; it was in the time when so much crinoline was worn; a small boy came up to her stall and made off with an apple without paying; she ran after him; with a strong breeze at her back she was quickly overhauling him, until a sailor, standing by, seeing with his nautical eye at a glance how matters stood, shouted, "*Try her on a wind, my boy.*" The moment the old lady had the wind against her she was nowhere in the chase, and the boy easily escaped with his apple. So will it be with the cruiser of the present day, if encumbered with heavy masts and sails. Captain Noel says that "his object in writing this paper was to win back some of the wavering to a sounder faith in sail power." But I should rather put it thus: that he is trying to win them back to an unsound faith in sail power. Captain Noel refers to the wonderful and almost historical passage of the "Vindictive." Now I think it is somewhat unfair to make so much of such an exceptional case: without putting against it all the slow passages on record, including such facts as that a sailing line-of-battle ship has been six weeks making the passage from Gibraltar to England. There is no doubt, however, that having masts and sails, and the power of being able to exercise men aloft, does certainly seem to make the seaman more active and cheerful; but I think what we gain in this exercise we lose in others which are of more importance to the efficiency of a vessel, especially when we reflect on the heavy shorthanded work that has to be done now in our men-of-war. There is one other thing we ought to take into our consideration in dealing with the question of masts and yards, and that is the number of men who have been killed or invalidated out of the service through accidents happening aloft, mostly at drill. Captain Noel has, apparently, in theory, produced a very clever plan for reducing masts and yards to a minimum in a very short time: this is, to my mind, a convincing proof that he is alive to the disadvantages inherent to heavy masting. Here I am quite of his opinion; and certainly, if we are going to retain heavy masts and sails for cruisers, it will be well to adopt his plans; but personally I think it far wiser to let masts and sails gradually die out than go to the expense of adopting any new system.

Captain CURTIS, R.N.: I may state, with regard to our old line-of-battle ships, that I was in one, the "Queen," that went out to Malta in ten days and a half. In 1846, the "Inflexible" paddle steamer, which was started to the Cape with half a regiment of soldiers on board, and 80 tons of coal short, by courting the wind, made the passage to the Cape in fifty days without replenishing coal. The true policy is to court the wind and not to ignore it, for we can never conquer it.¹ It is by ignoring the wind that many merchant vessels are lost: that is, we are told, the sea is impelled in a cycloidal curve form, and by keeping the maintop sail, close reefed in a gale, on the ship,—when youngsters were told never to take the main topsail off the ship, but to heel her over, "*and give her a weather side*"—by so doing we prevented the sea from overwhelming the ship. What I maintain is that by not having sail power the ships are very often overwhelmed by the sea. In doing away with the masts you do not actually gain the amount of weight which the masts and sails weigh, inasmuch as you have not the storage room in the ship. For instance, a mast does not take up any room below, and you cannot find space for the amount of coal that the masts, &c., would weigh. It is perfectly true that in the Baltic, in the Channel, and in the Mediterranean, it is a good practice to have mastless ships; but we are told that in the Pacific, the East Indies, and so forth, where we have sea-going cruisers, it is absolutely necessary that you should have coaling stations, for there is no coal port that we can go to between Vancouver and the Falkland Islands, on the Pacific Coast, that we can call our own. We put in at Valparaiso, but if we were at war with a Power friendly to Chili, do you think they would fill us up with coal, coal being a munition of war? I think it is out of the question. I perfectly agree with the lecturer and also with Admiral Boys; I do not think we have come to that enlightened period at which we can ignore the winds, but I think we must in a certain class of vessels maintain sail power, so as to enable us to keep the command of the sea; sail power is a necessity as a means of safety in a gale, and in case of mishap to the machinery.

Captain NOEL: My Lord, Ladies, and Gentlemen,—I think you have almost heard enough of my voice to-day, but I would nevertheless like to answer a few of Captain Colomb's remarks. First, as regards long passages. I think we must have certain vessels of the "Iris" class (carrying plenty of coal) to make the long passages, or passages with great speed; but I doubt very much whether the ordinary ship-of-war of our service would ever in war time be required to make long passages. With regard to the resistance of ropes, in my paper I have fully acknowledged the importance of this question, and have endeavoured as much as possible to get rid of the resistance due to the ropes. There is no doubt we have a very vague idea of what the cruising of the future will be, but "cruising" is a term which includes a great deal. It does not mean only remaining at a certain position. It means cruising from one port to another, and so on. It is in these short passages that we expend our coal, and my object in advocating masting is that in all those petty little movements from one port to another we should economize coal. Captain Colomb compares the "Hecla" with the cruiser. Now I consider, with all due deference to him, that it is an absurd comparison.

Captain COLOMB: I said as an illustration.

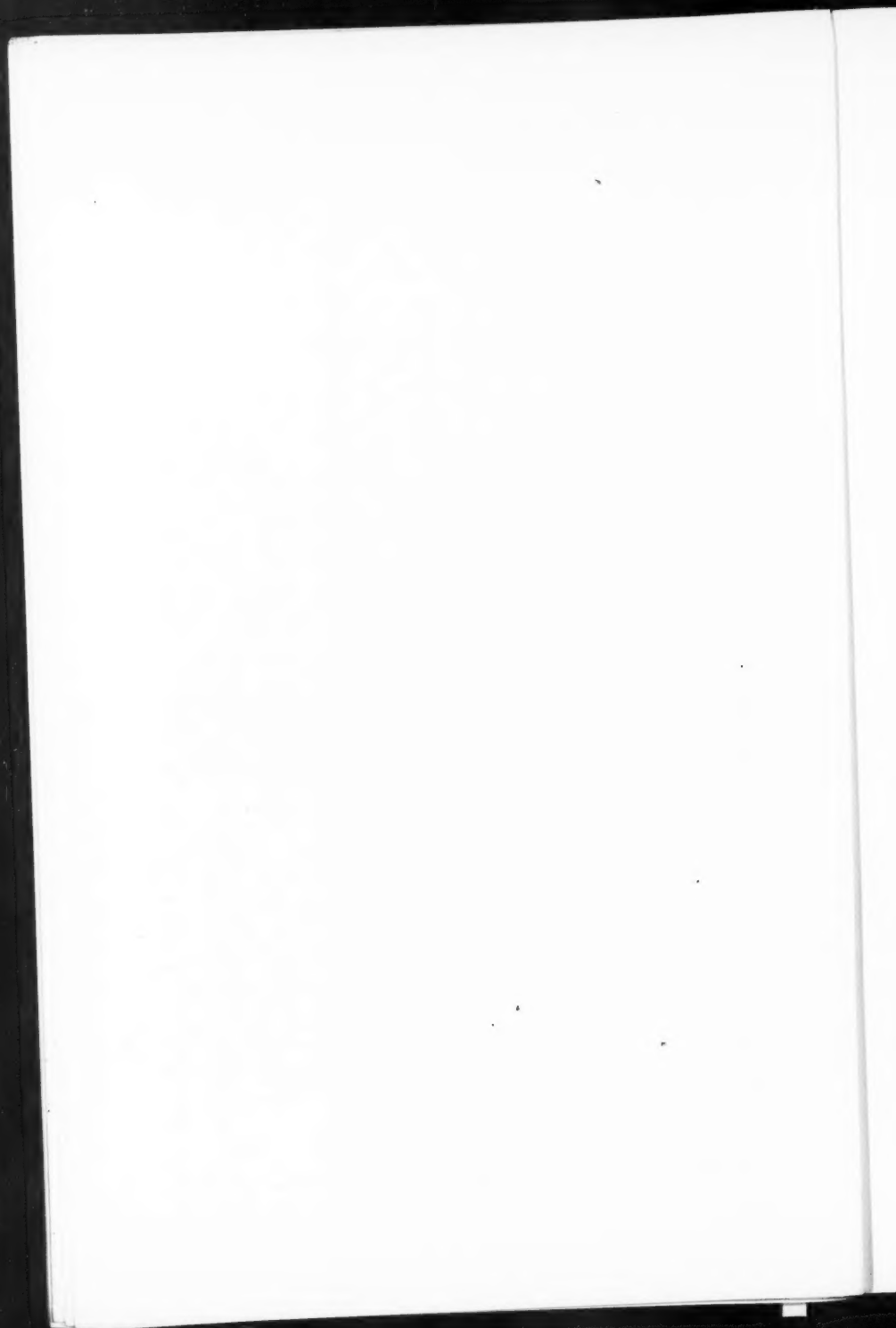
Captain NOEL: I meant that there is no comparison whatever between the two. There is no doubt that the "Hecla" can go round the world and not expend all her coal, but what is the "Hecla"? Simply a merchant vessel. She is not a fighting vessel; she has no great speed; she could not get away from the least of our cruisers; she would be taken by the first craft that could fire four guns at her. What I contend throughout is that if you are going to have the cruising vessels that Captain Colomb and Captain Harris are so anxious to introduce, you must have them immense. I think the other day Captain Jackson talked about cruisers of 10,000 tons, and I believe he is perfectly correct, if masts are done away with; you cannot otherwise carry the coal. Mr. Barnaby says, "I must have

¹ See Captain Washington's Report, 28th July, 1849, on the Loss of Life on the East Coast of Scotland, 19th August, 1848—"No boat ever known to be lost by shipping a weather sea; boats lost by not carrying sufficient sail, &c."

tonnage ; I can do nothing without tonnage ; I cannot get speed, and I cannot get coal-carrying power," and therefore it follows if you do away with your masts you must be prepared to have cruisers of 10,000 tons. Masts are a means of economizing fuel, and in that way you enable the country to have cruisers of moderate dimensions. The "Vindictive" was not a special ship. She was an old 60-gun liner, cut down and made into a 50-gun frigate, and about ten years after being cut down she made this passage—a most extraordinary passage, no doubt ; but she was not built as a special ship. Still I do not know why Captain Colomb should attempt to give us to understand that it was an extraordinary feat which only happens once in a generation. Against this impression we will just consider the clipper ships. The clipper ships were, we may say, almost as regular as the mails. Taking the tea-clippers from Foochow to the Downs in 1866, three made the passage in ninety-nine days, and two of them raced up the Channel. In 1868 the "Ariel" made the passage in ninety-seven days, and in 1869 the "Sir Launcefote" made the passage in ninety from Foochow to the Downs. What I say is, that if we thoroughly understand the sailing passage, we ought to be able to make it with almost the regularity of a steamer. Now we are throwing sail power out of our calculations, and the consequence is we are forgetting how to use it. Now about reducing the crews. I must say this is a most serious consideration. I fully concur in all that Admiral Boys said ; and this consideration alone, to my mind, makes it necessary that we should have masts as a means of employing the men. Captain Colomb has rather contradicted himself, for he tells us that we cannot find time for sail drill, &c., and then the moment afterwards he says, "According to the lecturer's diagrams he is going to make everything so nice and neat that we do not want the time, and should not have employment for the men." I wish to show that between the two we do get the necessary amount of employment for the seamen. When it is requisite to prepare for action, down would come the masting as easily as possible. We still have a gymnasium (as we may call it), which keeps the men employed, and which is conducive to discipline, order, health, and everything else. It is a very curious thing to me that whereas the military are making gymnasiums all over the world, we appear to want to do away with our gymnasiums. No doubt with old appliances it did take up a lot of time, and I daresay that squadrons, when they have many other things to consider, could not get time to work the old plans of masts and yards, but if you have improved appliances, you can keep up your exercise in peace time ; and when there are other duties to do, very little is required in order to reduce the masts or to make sail again. With regard to the area of strong sail, I can see no objection to obtaining a good area of strong sail in the proposed plan. In fact, I am for giving a good area of strong sail. Unlike housing your topmast before all, a telescoped topmast is entirely out of the way of the lower yard, and consequently your course is always ready for setting. I have thought of that difficulty referred to by Admiral Boys as regards bracing the yards up too. No doubt it is a very great danger. But when the topmast rigging and backstays are in place there is no possibility of bracing the yards any further forward than it would be now, and the topmast rigging would prevent the topsail yard going further than it would before. There is one other point, with reference to the question of coal. If you have no working crew on board a vessel, you must do everything with your auxiliary engines ; and in time of war, when our vessels are miles away from the coal stations, you will find that your coal is being used up by its daily consumption for auxiliary engines, and that will be very large, owing to the fact that you have not got a crew to do the work. Captain Colomb gave us some numbers of seamen, and said that you want the seamen to go aloft alone ; but I do not see why ; when making a sailing passage, the Marines and stokers can do the deck work. We do not want the stokers to go aloft so long as we have seamen who have been trained to do the work that is necessary aloft. Gentlemen, I am much obliged to you for your kind attention.

The CHAIRMAN : I am sure we are all very much obliged to Captain Noel for his very interesting lecture, and also to Captain Colomb for what he has said. Perhaps you will allow me to say one or two words bearing on the point. First of all with reference to the relative effect of winds on unmasted vessels, and on masted

vessels in bad weather when at an anchor. No doubt if Officers, commanding ships being in 20 fathoms water, let go their anchors and veer only to 40 fathoms of cable, something is likely to happen if a squall should strike them. Captain Noel, I think, has hit the nail on the head by saying that if you want cruising vessels under coals alone, you must have your ships of 10,000 tons. He has also alluded to the eternal working of your auxiliary engines in order to do the work on the ship, and I am sure no better illustration of that can be found than in the "Inflexible." There is also another point which must be considered. You have not got now, with your 110 rounds of shot and shell, half enough ammunition on board your ships. It is all very well in the Mediterranean, or the Channel, near your own ports, but what do you suppose would be the effects of the next action which takes place in the Pacific? I do not mean when you are close to Esquimalt, where you have got a depôt, but anywhere else, and that is a most serious consideration. You cannot have room for your coals, and shot and provisions, and therefore you must, in my opinion, trust very largely on distant stations to your sail power. The Italians have the largest vessel on the stocks and afloat, and they are going entirely for very large coal storage and mastless ships—just two trysails. In France, all the larger class of ironclads, like the "Redoutable," are having the yards taken out of them entirely; the lower masts are left, with a very strong battery of machine-guns on the top. In Germany they have not done away with the practice of having full-rigged ironclads; but this year, owing to the short time of their ships being kept in commission, they have decided to send steamers with lower masts alone, and with poles for the topmasts for signalling. I am afraid, by-and-bye, we shall have too much the same sort of thing, as we generally follow other people's notions, and I shall expect to see, before many years are past, all our ironclads in the same way. I shall be sorry to see it, because I think in the Mediterranean and the Channel you are so close to your own ports that at the first outbreak of war you could get rid of all your topmasts and yards instantly. Until then, I am quite convinced, it is of the utmost service to our men in every way to have the means of exercising them aloft. As I said the other day in another place, I am fast going into old fogeyism; but still I maintain the opinion that it is from the top-gallant and the royal yard men, and the men stationed aloft generally, that you get your best men, who afterwards will doubtless be found, under Captain Colomb's direction, filling shell, and employed in various avocations where the nerve that they had acquired at our mastheads will serve them in all other capacities so well. I beg, on your behalf, to return a vote of thanks to the gallant lecturer.



Friday, June 8, 1883.

ADMIRAL SIR FREDK. W. E. NICOLSON, BART., C.B., Vice-Chairman,
in the Chair.

HARBOURS OF REFUGE IN CONNECTION WITH THE SUBJECT OF CONVICT LABOUR.

By Colonel Sir CHARLES H. NUGENT, K.C.B., R.E.

It will perhaps be matter of surprise to some at least here present, why I, who neither am a naval Officer nor have any connection with convict prisons, should have undertaken this subject.

In explanation of my position here I may say that I have undertaken it at the request of the Council of this Institution.

Possibly the Council, the services of a more qualified exponent of this subject failing them, may have considered that long connection with the defences of Great Britain, which led me to a personal examination of nearly every bay in the United Kingdom, and necessitated a careful study of the Reports of the Commissions on Harbours of Refuge, as well as many years' personal experience of the employment of convict labour on large national works, were sufficient qualification for the introduction to you of this subject.

The interest in Harbours of Refuge has been recently revived, partly, perhaps, because Government is about to undertake the completion of Dover Harbour, and partly, perhaps, because it is understood that a Committee which was assembled in 1880-81 to consider the measures necessary for the defence of our principal commercial harbours was, in the course of its investigations, drawn to examine the merits of Filey as a position for a Harbour of Refuge on the East coast; and it is wise upon the part of the Council of this Institution, which has done so much to rouse public opinion upon many matters of national importance, to bring this subject before the public at the present time.

This may well be a subject of national interest, for it concerns a large portion of our population; it is not only the seafaring population and the shipowners who are concerned in this subject, but the shipbuilding and the mining and mercantile classes also.

Some idea of the magnitude of the interests involved may be derived from the number of vessels engaged in the commerce of the country and the number of seamen employed in them.

In 1881, 19,307 sailing and steam-vessels, of an aggregate tonnage

of 6,490,953 tons, were engaged in trading at home and abroad; they were manned by 168,098¹ seamen and boys.

In addition, 66,682 boats were occupied in fishing, manned by 124,561 men and boys.

So that the operatives afloat directly interested in, and to be benefited by, the creation of Harbours of Refuge number 317,464, and if the Royal Navy (45,100 seamen and 12,400 marines) be included the number rises to 374,964.

It is probable that at least 120,000 men are employed in the collieries, a great part of the produce of whose labour is sea-borne.

But the pecuniary considerations involved are very large, for instance, the actual value of the vessels afloat may be taken at 63,614,744*l.*, and the merchandize they carried last year was worth 694,155,264*l.*

Of course this latter figure is very fluctuating; it is 3,538,657*l.* less than in the preceding year, 1880, when it was 85,868,792*l.* greater than in 1879.

But fluctuate as it may, the value of the commerce always on the water is so great that neither pains nor money should be spared to insure its safety.

In the matter of Harbours, it is worthy of notice that, while of late years our Government has been supine, the French, with not half our trade,² have been most active. On the shores of the Channel alone, and within a length of 250 miles, viz., between Dunkirk and Cherbourg, they have undertaken works at nine harbours, representing an estimated expenditure of 5,574,000*l.*

Dunkirk	£2,000,000
Calais	748,000
Boulogne	680,000
Tréport	144,000
St. Valery	82,000
Dieppe	580,000
Fécamp	240,000
Havre	920,000
Honfleur	100,000
Cherbourg	80,000
	<hr/>
	£5,574,000

As preliminary to the consideration of our subject it may be well to state what the conditions are which a Harbour of Refuge should satisfy:—

1. It should be easy of access in all weathers.

¹ This is exclusive of foreign seamen, who numbered 24,805.

² Imports of France	£163,050,000
Exports „	123,080,000
	<hr/>
	£286,130,000

(Exclusive of Colonial trade.)

2. It should have ample and secure anchorage.
3. It should have good holding ground.
4. It should be available for as large a number of vessels as possible.

These are the aqueous and subaqueous considerations, which must have their due weight in the selection of a position for a Harbour of Refuge, but they must be influenced by other, terrestrial, considerations, such as the nature and form of the adjoining ground, and whether these lend themselves to economical construction, also whether they afford facilities for communication with the commercial centres of the district.

The Royal Commissioners on Harbours of Refuge, in their Report in 1859, drew a marked distinction between *Harbours of Refuge*, in which in bad weather, "all vessels," not those only habitually frequenting that part of the coast, "should be able to take shelter for the purpose of avoiding the risks and wear and tear incurred by keeping the sea, and the loss of time occasioned by being driven back;" and *Harbours*, styled by them *Life Harbours*, of which "facility of access and sufficient shelter are the essential requisites," and of which the positions must be governed by local considerations.

It is not my purpose to devote much consideration to these latter, which the Commissioners recommended should be constructed, either out of funds raised locally, or out of part local and part Imperial funds, and should be thereafter maintained by tolls levied on the vessels making use of them.

The object of the Council is that attention should be drawn to *Harbours of Refuge*, designed to offer hospitality to all vessels alike, independent of nationality, and which, being for the general good, should be constructed and maintained, as national undertakings, out Imperial funds.

If then the Imperial Government undertake the construction of harbours of refuge, the question for its consideration is how it can most economically construct them.

The answer is not far to seek. In the convict prisons it has a large body of men, about 10,000, whom it is compelled to maintain, and for whom, on social even more than on economical grounds, it is compelled to find employment. Fortunately the form of labour most suitable for their employment is precisely that which enters so largely into the construction of some descriptions of harbours of refuge.

I refer to unskilled labour, or to labour so comparatively unskilled that expertness in it can be acquired in a short time, and well within the average duration of penal sentences.

There are other forms of work upon which labour can be applied in large bodies, such as the Dock Extensions at Chatham and Portsmouth, and the massive fortifications at Portland, but these are beside the subject of this paper, and I refer to them here simply because the labour of the convicts upon them has been attended with satisfactory pecuniary results; no doubt, the main portion of these works consisted of unskilled labour, and the nature of the works was such that convicts could be employed in considerable numbers upon them.

When employed in small numbers the labour of convicts will not be remunerative.

In my opinion, not less than 500 convicts can be profitably employed upon any one independent work, though I am aware that it has been proposed to make use of as small a number as 200.

In the "Report of the Directors of Convict Prisons for 1881-82," I find that upon the War Department and the Admiralty works at Portland the proportion of unskilled labourers is about two-thirds of the number of prisoners employed on them; the exact figures are '648. I find also that the average number of male prisoners does not vary very much from year to year; that last year the number was 10,221, and that 8,489¹ of these were undergoing sentences of five, seven, and ten years, and I assume for the purposes of this paper that a totally unskilled but able-bodied prisoner can become expert,—as a labourer in one year, as an excavator in one and a half years, and as a quarryman in two years.

It is no mere assertion on my part that the construction of certain descriptions of harbours of refuge does afford unusual facilities for utilizing convict labour; it rests upon the experience of the employment of convicts for upwards of fourteen years in the construction of Portland Breakwater and Harbour works, which is perhaps the most successful construction of its kind, and upon their employment upon several similar constructions abroad.

In a paper read before this Institution in March, 1875,² by the eminent Civil Engineer by whom these works were constructed, it is stated the cost per acre of sheltered anchorage, taken over the deep water portions, was—

	£
At Portland, built with the aid of convict labour	800
„ Plymouth.....	1,897
„ Holyhead	6,425
„ Dover	12,755

The difference in cost is of course only to a limited extent attributable to saving consequent upon the employment of convict labour; much is no doubt due to the advantages the harbour of Portland owes to nature in respect both of form and of depth of water, as well as to the position and description of the adjacent beds of stone of which the breakwater was formed, and the mode of construction adopted; but still, crediting these as largely as you may, enough remains to point to a decided economy from the employment of convict labour.

I may remark here that the so-called island of Portland is an exceptionally excellent position for a prison establishment. Its almost isolation from the adjacent land of Weymouth, with which it is connected by a narrow beach of shingle, $2\frac{1}{2}$ miles in length, renders

¹ 3,045.....	5 years.
3,637.....	7 „
1,807.....	10 „

8,489 Total.

On "Military (or Strategic) and Refuge Harbours." By Sir John Coode, Kt., M.I.C.E. Journal, vol. xix, No. LXXXI.

escape in that direction well nigh impossible. Elsewhere it is washed by an unkind sea. The form of the "island" and the absence of trees, which offer nearly the whole of it to observation from its highest point, combined with the paucity of the inhabitants and their habits of reserve, render the maintenance of discipline an easy task.

It is difficult to find another position which lends itself so conveniently to the employment of convict labour, but I shall by-and-bye be able to indicate at least one position that is not far short of it in such natural advantages.

It may be said that in undertaking any new work by convict labour it will be indispensable to erect Prisons with the necessary accessory buildings, that the cost of these will be very great, and so far unnecessary that in all probability, seeing that the number of prisoners shows no sign of annual increase, the existing prison accommodation will be sufficient for prison purposes for years to come.

In the Report already alluded to, it is stated that in the quinquennial period 1877-82, while the population of England and Wales has increased by $1\frac{1}{2}$ millions, the number of prisoners (convicts) has actually decreased; it is less by four in 1882 than it was in 1878.

Though it does not enter into my subject, I may be permitted to observe here that this is a most gratifying result; there are other gratifying results recorded in this Report, especially the diminution in the proportion of younger criminals, but I may not dwell upon them now.

Before dealing with the cost of a Prison Establishment, I would remark that after all economy is secondary to the industrial and reformatory employment of prisoners; nevertheless, admitting that the cost of a new Prison Establishment is unremunerative expenditure, it is but a small portion of the expenditure upon a large work such as a Harbour of Refuge.

The Royal Commission of 1879 on the Penal Servitude Acts observe upon this point: "No doubt, even if it were not advantageous in a pecuniary point of view to employ convicts upon public works"—such as Portland Harbour works—"it would still be most desirable that such employment should be found for them, as an essential part of penal discipline."

Assuming that a prison establishment for 1,000 prisoners would cost 75,000*l.*, this would represent the first charge for the employment of 1,000 prisoners upon a great Harbour of Refuge, after which the annual charge for prisoners, no matter how long the duration of the work, would be about 4,500*l.* per annum.

From the same Report it appears that the average annual charge¹ to

¹ Annual charge:—		£	s.	d.
Portsmouth		9	12	1
Borstal		7	4	11
Chatham		1	12	3
		18	9	3
Deduct for Portland		0	13	3
Total		£17	16	0
Average per prisoner		£4	9	0

the country per prisoner in the four prisons of Portsmouth, Borstal, Chatham, and Portland is 4*l.* 9*s.*, after defraying the salaries, and charges, for the staff, for victualling and clothing of prisoners and their officers, for repairs to buildings, and all incidental charges.

The more quickly the work is executed the less will be the charge for labour, for plant, and for such supervision, and there must be some such, as is entirely civil.

Let us assume that the percentage of labour in such a work as we are considering is 25 per cent., and that a prisoner does about two-fifths of the work of a free man, the saving arising from the employment of prison labour will be 10 per cent., but the contractor's profit will also be saved, and this may be set down at 10 per cent., and so will a portion of the charge for superintendence, say 2·5 per cent.; so that the net saving arising from the employment of prison labour may not unfairly be stated at 22·5 per cent., which in a work costing 1,000,000*l.* amounts to 225,000*l.*

Setting the cost of a prison establishment¹ at 75,000*l.*, and the sum of the annual charge for twenty years, reckoned at 4,500*l.* per annum, at 90,000*l.*, the saving above is reduced to 60,000*l.* Probably a large portion of this will be absorbed by the enhanced charge for plant, which charge will rise with the length of time in which the work is under construction, and by the increase in the charge for insurance against damage from storms, which will rise also, but in a still greater degree, with the time the work is under construction.

So that even if there be little or no saving, it may be confidently stated that there need be no loss, consequent upon the employment of convicts, even if they consume, which is not improbable, twenty years in doing what might well be done by free labour in twelve years.

But, after all, extreme rapidity is not a matter of vital importance in such constructions, as the water which they enclose can be made use of by shipping while they are in progress. Moreover, the employment of prisoners is attended with this further advantage, viz., that Government retains the work in its own hands, and is at liberty to vary at pleasure the design to meet unforeseen circumstances, and in such works, even with the most careful prevision, every circumstance will never be foreseen, whereas if the work were placed out at contract such variation would be inadmissible, or would give rise to extra cost and constant dispute.

The subject of Harbours of Refuge has been so long before the public and has been so much discussed that it is no longer a question of whether they are needed, the question is where they are needed, and in choosing a position for such harbours the still existing tendency of ships to increase in size cannot be overlooked, as this, by rendering very large and open harbours a necessity, practically very much lessens our choice.

It might, indeed, be thought that steam would have rendered vessels to a high degree independent of weather, and that so the necessity for Harbours of Refuge would be less, but this does not, I think, prove to

¹ For 1,000 prisoners.

corstal,
s, and
rs and
charge
e some

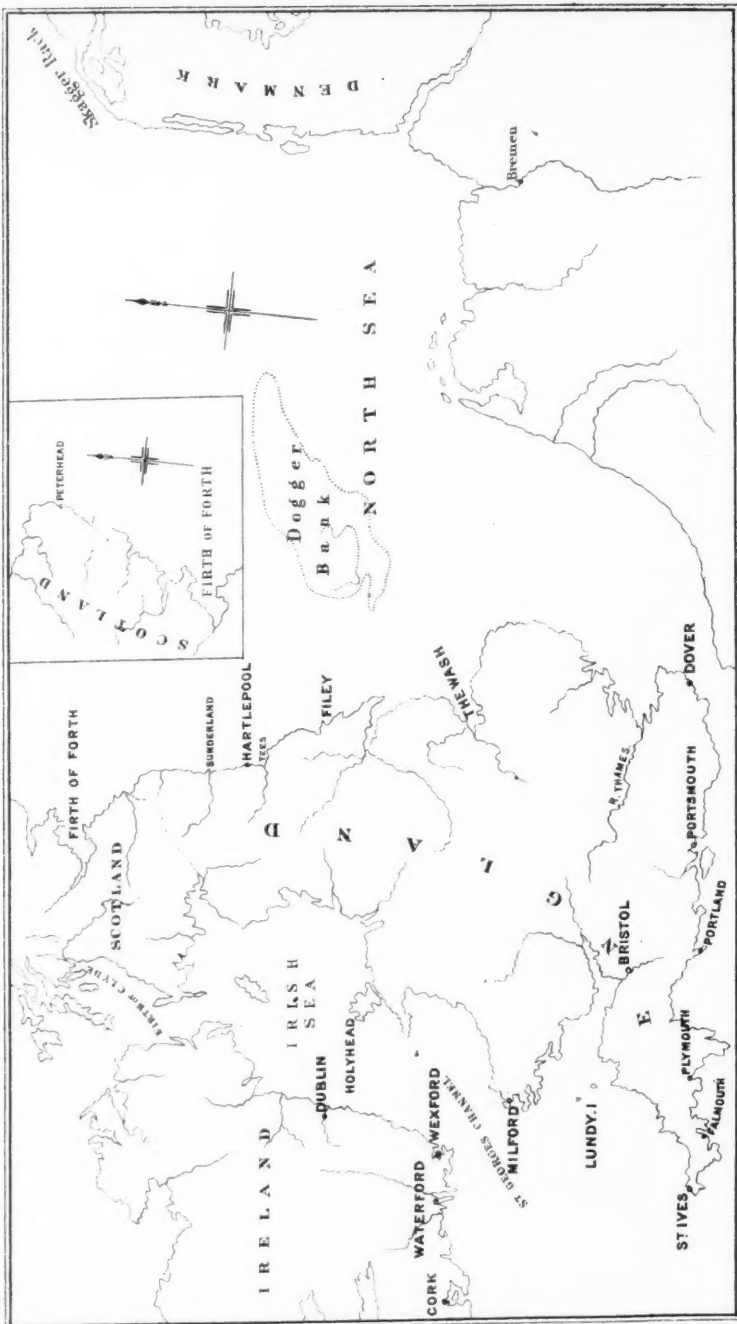
as we
t two-
employ-
profit
and so
nt.; so
labour
costing

ne sum
annum,
a large
plant,
work is
urance
greater

idently
ment of
y years
s.
ortance
e made
he em-
re, viz.,
liberty
and in
stance
contract
ra cost

public
tion of
ed, and
ndency
ndering
much

vessels
sity for
rove to



be the case; there are various classes of steam-vessels built, and if true of the highest classes and of the best of their classes, it is by no means true of the older and of the inferior classes, which not only make indifferent weather, but are manned by less efficient seamen than were the sailing vessels of the past time; moreover, the smaller coasting and fishing craft have to be cared for as much as ever.

But a Harbour of Refuge should be available for the ships of Her Majesty's Navy as well as for trading ships, and, therefore, should not only be placed conveniently for their use, but be of a construction to meet their wants.

If you direct your attention to the map of Great Britain, you will see that the East coast claims the first consideration, the South coast is already well provided, and the West coast, which is not so much exposed as the East coast, has already three points of refuge.

When this subject was last before this Institution, and I may say was last prominently before the Public, the claims of the East coast were obscured somewhat by Dover Harbour, but the recent resolution of Government to complete this harbour has removed it from the sphere of discussion, and there is no longer rivalry between the two.

When I commenced to consider this subject, I had it in my mind to leave untouched the military aspect of the question, but I soon found that it was impossible to disconnect civil from military considerations, inasmuch as the very circumstances which tend to collect the shipping of the Kingdom to one spot, either as a place of refuge or as a port of call, render that spot an objective point for an enemy, and, moreover, in many cases at least, the facilities of water and of land, which serve to render particular sites eligible or preferable as Harbours of Refuge, serve also to render them good Bases of Operations for an enemy.

It is impossible, then, to discard from consideration the military aspect of the question, and I am the more satisfied with this conclusion, as the eminent Civil Engineer who dealt with this subject in this Institution in 1875 found here strong ground.

I mention this lest civilians, if such there may be here to-day, should carry away the impression that a military man can only treat a subject from a military point of view.

The military considerations which at once suggest themselves are,—that it should be possible to prevent an enemy from entering or obtaining possession of the Harbour, or, indeed, from destroying from a distance the shipping collected therein;—this is a matter of some difficulty in these days of long-ranging guns and of armoured ships;—that if, unfortunately, he has succeeded in getting possession of the Harbour, he should not be able to remain in it; these two considerations require for their fulfilment a particular form of Harbour, which in its turn needs, or is best attained by, a particular coast line, and by a particular configuration of the ground which surrounds and shelters the shore.

It has been already stated that the South coast is well provided with Harbours of Refuge; it has three artificial Harbours, all of the first class, Plymouth, Portland, and I suppose I may include Dover,

with the outlying Harbour of Alderney; it has also the great natural Harbour of Portsmouth, and the minor Harbour of Falmouth.

Upon the West coast there are Milford Haven and the Firth of Clyde, with the intermediate harbour of Holyhead, so that upon this coast there is already some refuge, but upon the East coast, for a distance of 405 miles, viz., from the Thames to the Firth of Forth, there is no Harbour which ships can make in all weathers, or in which they can coal with absolute certainty in all weathers.

The intermediate Harbours either are not suitable for the vessels of the great size of the present day, or are difficult to make in bad weather.

Yarmouth Roads, in which Nelson's fleet lay so long, and which was often the rendezvous of our fleets, has lost its usefulness in consequence of changes in the sand to which the roadstead owes its existence, the southern entrance having become "barred" to vessels of size, and the northern entrance having become prejudiced by patches of sand.

Hollesley Bay is no longer suitable for large vessels.

Harwich Harbour has only 16 feet of water at low water, and the entrance is through a narrow channel with a sharp turn in it.

The Humber, with wind from the eastern quarter of the circle, is not a water in which vessels may ride with safety.

The Tyne is the outlet of a small river, and no vessel could attempt its entrance in certain weather, or could remain in it with comfort, if it succeeded in entering.

I believe I have fairly summarized the Harbours on the East coast, and it is sufficiently evident that not one of them will satisfy the conditions essential to a Harbour of Refuge.

Careful consideration and personal examination of this coast have led me to the conclusion that the Royal Commissioners of 1859 were right in recommending Filey as the place for a Harbour of Refuge on the East coast.

Moreover a deliberate consideration of the evidence taken by the Commissioners impresses upon me that the balance of advantages is in favour of Filey. But I set great store by the opinion of Admiral Sir James B. Sullivan, one of the Royal Commissioners; with some experience both of naval and military surveyors, I have never met anyone whose eye for ground, if I may use the expression nautically, was so good; he strongly recommends Filey as satisfying the conditions of a Strategic Harbour, as well as of a Harbour of Refuge; he points out that in addition to its advantages of position, it is within reach of our numerous coal-fields, and he mentions, one very conclusive fact, to my mind at least, "that while each witness said his own port was the best, they all said Filey was the second best."

There are no dangerous banks or shoals in the neighbourhood of Filey; the coast here compares in this respect favourably with other parts of the East coast.

Filey might become a great rendezvous for fishing-vessels; it is 60 miles from the Dogger Bank, and the centre of the best fishing-ground on the coast of Great Britain.

The bottom in Filey Bay is Speeton clay, similar to the Kimmeridge clay at the bottom of Portland Bay, and is of a singularly tenacious character.

For strategic purposes Harbours of Refuge require development in other directions; they should have facilities for coaling, abundant supplies of water, plenty of wharfage, and ample means for the embarkation and disembarkation of troops, horses, guns, and all the munitions of war, and for this purpose they should be in direct communication, by rail and by telegraph, with the military centres and arsenals.

It has been estimated that a Harbour of Refuge of the most ample dimensions may be constructed at Filey for 1,000,000*l.*; say that it will cost 1,250,000*l.*, this sum, large as it is, is a mere trifle, somewhere about $\frac{1}{4}$ th per cent. upon the annual foreign trade of the country, which may be roughly stated to be at present 700,000,000*l.* with no upward tendency.

From the Returns made to the Board of Trade, of sea casualties, which occurred on the coasts of the United Kingdom, or were reported as having been met with Abroad, I find that last year the total losses of vessels were 1,303 of, in the aggregate, 378,424 tons, of which 174 were steamers, of, in the aggregate, 103,284 tons, and 1,129 were sailing vessels, of, in the aggregate, 275,140 tons; and that in addition to this there were 1,622 serious casualties, to 508 steam, and 1,114 sailing vessels, of, in the aggregate, 696,971 tons, by which much destruction was wrought to both vessels and cargoes; also that there were 3,470 minor casualties to 1,039 steam, and to 2,431 sailing vessels of, in the aggregate, 1,140,123 tons, of which it is not necessary to take notice here.

The gross total of British vessels lost or injured last year (1881-82), was 6,395, of, in the aggregate, 2,585,418 tons.

Going back to the total losses, if we value the classed steam and sailing vessels at 12*l.* and 8*l.* per ton, respectively, and the unclassed vessels, though these are probably classed in the smaller registries, at 10*l.* and 6*l.* per ton, respectively, the loss of property in vessels alone amounts to 3,265,656*l.* It would not perhaps be far wide of the mark if their cargoes were valued at one-fourth as much more, in which case the value of the property lost would be 4,082,070*l.*

It is very difficult to assign a value to the damage done to the shipping which suffered serious casualty, at least without spending over the Tables issued by the Board of Trade more time than I have had at my disposal, but the value of the vessels alone, calculated as above, is 7,087,640*l.*, and estimating the cargoes as before, and that both suffered depreciation of one-fourth,—the value of the property so lost would be 2,214,887*l.*, and the loss last year in British vessels at home and abroad may be stated at over 6,000,000*l.*

It is proper to observe that the casualties last year were above the average.

It would appear from the same Tables that the British vessels, lost last year on or near the coasts of the United Kingdom, were 444, amounting, in the aggregate, to 70,214 tons,—and which suffered

serious casualty were 615, amounting, in the aggregate, to 146,830 tons; using the same method of calculation as before, the gross value of the property lost on or near the coasts of the United Kingdom was 1,615,726*l*.

But if allowance be made for 82 and 104 foreign vessels, of, in the aggregate, 13,000 tons and 24,471 tons respectively, which were lost and suffered casualties on the coasts of the United Kingdom, the amount of property lost rises to 1,806,903*l*.; and if we assume that two-sixths of this was lost between the Forth and the Thames, the gross total of property lost upon this portion of the East coast may perhaps be set down at 722,760*l*.

In the same year 1,097 lives were lost upon the coasts of the United Kingdom; of these 289 were lost between the Fern Islands and the North Foreland, between which places 121 vessels were lost, and 213 vessels suffered serious casualties.

I am far from saying that these lives and this property, or even the greater portion of both, would have been saved to the nation if there had been a Harbour of Refuge in the centre of this danger-fraught and unprotected coast; but I do say that if there were a Harbour of Refuge there, we might with reason anticipate an important diminution in these melancholy figures.

But the 1,097 lives lost by no means represent the dangers which lie about our coasts; in the same period 4,066 lives were saved from shipwreck; and the total, 5,183, which represents the number annually in mortal and preventible peril, may well spur us on to spare no means which afford a hope of mitigating this peril.

It has been already stated that the total of the Foreign and Colonial Trade of the United Kingdom was last year 694,155,264*l*.; deduct from this the trade of London and Liverpool, 394,264,025*l*.; of the remainder, 299,891,139*l*., one-third belongs to the East coast between Berwick and the Thames; the exact figures are 96,118,898*l*.

But judged by the tonnage, the coasting trade on this part of the coast is nearly, if not quite as much more, so that possibly the passing trade may be set down at 190,000,000*l*. annually.

The Foreign and Colonial Trade of the East coast is nearly twice as large as that of the South coast, and about $4\frac{1}{2}$ times as large as that of the ports of the Bristol Channel, the exact figures for these being 50,606,421*l*., and 22,896,283*l*. respectively.

In the gale of autumn 1880, the wind blowing from the north-east, many vessels were wrecked and 164 lives lost upon this coast, and a large number of these were lost south of Filey between Flamborough Head and the coast, having been driven down and wrecked for want of shelter.

In the gale of October, 1881, wind blowing from the north north-east, 36 vessels out of a total of 45 were wrecked between Berwick and the Wash.

It must be conceded then that the East coast, between the Thames and the Forth, a distance of 405 miles, claims first attention.

1. Because it is unprovided with any Harbour of Refuge.
2. Because its passing trade is far in excess of that of any

equal extent of coast (excluding the mouths of the Thames and the Mersey).

3. Because the proportion of casualties is greater thereabouts than upon any equal extent of coast, excluding the Thames and the Mersey.¹

Great energy has been manifested, and much money has been spent in improving the local Harbours at the principal ports of this coast, but they do not supply the want. This is clearly shown by the return of casualties in the rivers and harbours of this length of coast, which are 28 of the casualties in the rivers and harbours of the United Kingdom, the mouths of the Thames and the Mersey being excluded; and the Royal Commissioners of 1859 state that the preponderance of evidence—being that of thorough seamen and highly intelligent men, the greater part of whose lives had been passed at sea upon the coast,—was in favour of a Harbour of Refuge at Filey, as that which would prove most conducive to the saving of life.

It appears, moreover, that fishermen from all parts of England resort in the autumn² to this coast to engage in the herring fishery, and that no other spot would be so convenient for refuge for them.

The Commissioners add that for convenience as a port of call, for the collection of convoys, for security from attack, and for a naval station, every advantage would be afforded by the position of Filey.

In this I thoroughly agree with them, and I will add that the nature of the bottom and the complexion of the adjoining coasts are such that there is little likelihood of a Harbour there silting up.

Moreover the locality is very suitable for the employment of prison labour.

The country is open and thinly inhabited, there is an excellent position for a Prison Establishment a little in rear of Filey Point, upon level ground of moderate elevation, 100 feet above the level of the sea, which may be easily cut off from the world by a very modest expenditure of fencing. The point itself is a hard oolitic stone of fairly good quality,—the middle oolite,—easily worked, but very enduring in water, in fact very similar to the stone at Portland of which the breakwater there was made, and the process of construction would probably follow the same lines, viz., quarrying near the point, running

¹ Take for instance the fishing trade: eleven-twentieths of the fish caught in the United Kingdom passes inwards through four ports of the East Coast.

In 1878 the quantities passed through these ports were:—

Grimsby.....	59,407 tons.
Hull	26,938 „
Scarborough	7,133 „
Whitby	3,600 „

97,078 tons.

The total now, 1883, probably much exceeds 100,000 tons.

In 1859, 600 boats and 5,000 men were so engaged. In 1876, the number of boats of 15 tons and upwards was 953, with an aggregate tonnage of 52,119, in number one-third, in tonnage two-fifths of the fishing boats of the United Kingdom.

the quarried material down the inclination formed in quarrying, and depositing the material by tipping it into the water from a timber staging, or possibly by means of hopper barges. A portion of the upper part of the breakwater would probably be constructed of either squared stone, or Portland cement concrete blocks made with broken local stone, making use as far as possible of the natural ledge of rock called Filey Brigg, which is indeed a continuation of Filey Point, and run out for about 1,100 yards in a direction most suitable for the commencement of a breakwater.

This ledge was turned to such a use by the Romans, who made a harbour here, the remains of which are still to be seen under water.

As far as the security of the prisoners is concerned the position here is almost as favourable for a Prison Establishment as the position at Portland.

Strategically Filey is most convenient; it is almost central, it is the same distance from the outlet of the Baltic and from Bremen, and it is nearer than the Forth to the outlet of the Baltic, while it is almost the same distance from Bremen as Dover; it is therefore the very best place for protecting the coast, while it is also the best place for commencing offensive operations towards either of the localities indicated.

This will be clearly seen by an examination of the accompanying diagram.

Defensively it is much favoured; the Front of the proposed harbour from Reighton to the point would probably be 6,000 yards in length, and as the breakwater would probably have a saliency of 1,600 yards in advance of this Front, advantage might be taken of the saliency for an advanced work on the breakwater, the flanking works being placed on Filey Point and about Reighton.

The wolds overlooking the bay are open and rolling, and afford good fighting positions, in the event of a hostile landing being made either above or below Filey, while favourable sites can be found on them for defensive works; these works should be constructed by the convicts as the harbour works proceeded, and need not be very costly.

Upon the West coast of England the recommendations of the Royal Commissioners of 1859 appear to have been limited to that part of the coast between Land's End and Hartland Point, considering doubtless that the upper part of this coast was sufficiently provided for by Holyhead, and by existing smaller harbours, mostly upon the Irish coast, in the improvement of which they proposed to spend about a quarter of a million.

The expediency of spending so much upon these smaller harbours is, to my mind, doubtful; in some of them the water is so shallow and circumscribed, and the entrance so narrow, that after all is done the accommodation must be of an inferior character.

But between the Land's End and Milford Haven some refuge appears to be wanted, and though St. Ives Bay, the position selected by the Commissioners, is good, it does not appear to me as good for commercial purposes as Lundy Island, from which their favour seems to have been diverted by the expense of construction consequent upon

the depth of water round it; the depth to be dealt with varies from 7 to 12 fathoms.

It certainly is not as good strategically, for Lundy is central, and it is not as good a position for the employment of convict labour, for which a small island standing away from the coast in deep and often troubled water seems in every respect suitable; if the work be performed by convict labour neither expense nor time need be main considerations, especially as discipline can be well maintained, and the place must be exceptionally healthy.

Moreover, the area proposed to be enclosed at St. Ives, at an estimated cost of 140,000*l.*, is comparatively insignificant, amounting altogether to 180 acres, of which not 100 acres would be available for the largest class of vessel.

For the southern portion of the West coast I propose Lundy Island, and, strategically, this part of the coast will then be well provided. If you cast your eyes for a moment upon this diagram, you will see that the waters here will be strongly guarded, and that the important places higher up the Irish Channel, to which they give access, are cared for.

The strongly fortified harbours of Cork and Milford, and a well-defended national Harbour of Refuge at Lundy Island, with Waterford, a defended harbour for swift vessels, of lighter draught of water, but heavily armed, a little in rear of the centre, form a military position so unassailable, that I doubt an enemy's attempting it.

But after all the necessity, either on commercial or strategical grounds, for a Harbour of Refuge here, is not nearly so pressing as it is at Filey; probably, too, with Dover and Filey on hand, there will be no convicts to spare for such purposes for some time to come, and Lundy may well wait.

I am aware that places other than those recommended by the Royal Commissioners have found strong local advocates, and since I have been engaged upon this subject I have received communications with reference to some places. In some cases my want of knowledge of the locality has unfitted me for their consideration; in others, the proposals were so evidently guided by local wants that they seemed foreign to the subject of this discussion, and if, therefore, I do not bring them forward, it is not from want of courtesy to my correspondents.

Moreover, there is a feeling upon the part of some shipowners that Harbours of Refuge are not an unmixed good, to quote the words of the Provost of Montrose, in these times shipowners do not like Harbours of Refuge, and do not want their ships to go to harbour if it can be avoided.

In one sense that is a right feeling, especially if it should lead to ships being well found and carefully manned; but whether or how far we may give our assent to such feeling, it is evident that Harbours of Refuge may be easily multiplied too far, while for strategical reasons the fewer they are, enough being provided, the better; our fleet is not numerically very large, the Colonies and the great water highways of our carrying trade must demand a large portion of it for

their safeguarding, and it is above all things expedient to retain the ships which remain in as little divided a state as possible; a few well-chosen strategical positions in which our ships can, if necessary, find shelter, coal, and water, with munitions of all kinds, and from which they can operate in masses large enough to keep an enemy's attention rivetted upon them, afford the best guarantees for the defence of these islands, and for retaining in our own control the enveloping waters which have hitherto been our best protection.

Thus may, to use the Laureate's words—

“ Her throne be kept unshaken still,
Broad based upon the people's will,
And compassed by the inviolate sea.”

Captain Sir GEORGE NARES, K.C.B., R.N., Board of Trade : It is impossible offhand to criticize in detail such an important paper as we have had placed before us by Sir Charles Nugent. However, before any remarks are made upon it, I would take exception to the wording of the heading. It is termed “ Harbours of Refuge in Connection with the Subject of Convict Labour.” Sir Charles tells us that we cannot employ with advantage less than a certain number of convicts, and that the harbours that they construct are not to be considered in connection with the time occupied on the works. Now I say that you cannot thus couple harbours of refuge from storms, with convict labour, although you may so connect large strategical harbours where the constructive works can be carried on for a large number of years. For instance, we are told that perhaps in twenty years we shall have Dover completed. Are we to wait all that time for the important harbour at Filey, which, as Colonel Nugent tell us, is wanted not only by the nation, but by the fishing and maritime population? If constructed by convict labour it will be the next generation before it will be even commenced; are we to wait all that time? We are told that the number of people connected with the mercantile marine at home and abroad is 160,000 seamen and boys, and that our fishing population numbers some 124,000 seamen and boys. Now if we deduct the number engaged in the foreign trade that are actually absent from Great Britain, it follows that there are at any one time a greater number of men employed in the fishing boats dependent upon harbours for refuge from storms than there are in the larger vessels engaged in the coasting and foreign trade. What we most want for refuge purposes is a large number of small harbours all round the coast for the men engaged in the fishing boats and smaller coasters.

Captain T. A. SWINBURNE, R.N. : I wish to make an exception with regard to Filey. I think it would be very much more advantageous to have the harbour of refuge in Tees Bay. Tees Bay is the weakest part of the British coast, Middlesbrough, Hartlepool, Sunderland are all unprotected. That would be the great centre both as a harbour of refuge and a harbour for coaling and supplies of all kinds for our ships; what is more it is in a bight on the east coast, and the deepest part of the bight in Tees Bay. Ships taken with an easterly wind of course run for the bight. I think the harbour should be at Tees Bay and not at Filey.

Admiral Sir ERASMUS OMMANNEY, C.B., F.R.S. : The chief points to be considered in the employment of our convict labour are those connected with Imperial and commercial interests, those connected with the punishment of criminals, and also with their reformation. Taking all these points into consideration, I think there is no better return to the nation for the money expended, than that of employing convict labour in the construction of breakwaters or ports of refuge all round our unsheltered coasts. Every breakwater built must add to our national wealth. The only criticism I should wish to make is that there are certain places in which I think convict prisons give a comparatively unremunerative return for the great expenditure upon them. Take for instance Dartmoor Prison. Perhaps, Colonel Nugent, you will inform us what we get in return for the great expenditure of money there compared with what you are now advocating, such as the construction of the harbour of Filey. I have no doubt there are a great many of my brother

Officers here who will bear out the very important Imperial results that we have attained in the work thus carried out. Take for instance the dockyard at Bermuda, and the mole at Gibraltar, and consider what great benefits we now derive from these works as a maritime nation. I quite agree with what Sir George Nares said. It is not only in the completion of our military ports that we can employ convict labour, but there are many points on the coast on which breakwaters would be of essential value for the protection both of our coasting trade and for fishing vessels. Take one point for instance, which I think has escaped your notice. Mounts Bay. There is a reef of rocks there which affords foundation for making a very admirable harbour of refuge, where they could more readily find shelter instead of going to Falmouth. I think that looking at these four considerations, Imperial, commercial, the punishment and reformation of convicts, there is no better return to be gained for this country than by the employment of convict labour in the construction of breakwaters.

Sir JOHN COODE, C.E. : I congratulate the Council and the members of this Institution on the choice that they have made of a writer on this very important subject of harbours of refuge in connection with the employment of convict labour. The paper bears evidence in itself that the writer has dealt with the subject in no ordinary way. His is not a mere theoretical view of the matter, for it was my pleasure, if I may be permitted to say so, one of the pleasantest professional associations of my life, to work side by side with Colonel Nugent for very many years at Portland, he on the fortification branch, and I on the harbour construction branch of that great national work. I was in communication with him I may say daily, very often twice a day, and therefore I know the thorough and intelligent way in which he entered into, and made himself master of all the facts and bearings of this question of the employment of convict labour. If I gathered rightly what fell from Sir George Nares, the exception he took was simply this, that Colonel Nugent has called these harbours, harbours of refuge, rather than strategical harbours.

Sir GEORGE NARES : The Council, not Sir Charles Nugent.

Sir JOHN COODE : Who chose the title I do not know ; but I am of opinion that a strategical harbour on the east coast of England is a great want of the day, and that the subject is one which should come naturally before this Institution. It was from a strategical point of view that I as a civilian (wisely or unwisely) undertook at the request of the Council of this Institution to treat the subject some seven or eight years ago. The views enunciated by Colonel Nugent in this paper are so entirely in accordance with those which I laid down in a professional report—no less I am sorry to say than a quarter of a century ago—with reference to Filey as a commercial harbour, and so fully in harmony with the views which I had the honour of putting before this Institution about eight years ago, that I really have very little to say on that branch of the subject to-day. I should like to be permitted here to say that I cannot yet see why Dover should have priority over Filey. I may be held to be prejudiced in favour of Filey, but whilst I am free to admit the importance of Dover, I see a still greater need for a strategical and a refuge harbour for the mercantile marine and for the fishermen on the east coast of England, and I say that the spot on that coast which *par excellence* is best adapted for such a harbour is Filey Bay. Whether you take it from a national point of view as affording more profitable employment for convicts, or as yielding a greater benefit for the expenditure of a given sum of money, the claims of Filey are, in my judgment, decidedly superior to those of Dover. I think Colonel Nugent was not a little hard upon the Tyne. A great deal has been done on that river, and the Tyne has rendered very good service to many vessels overtaken by storms ; still occasionally when there happens to be a strong easterly gale blowing, and at the same time a considerable quantity of flood water coming down the Tyne, there is what sailors call a “nasty” sea at the mouth of the Tyne, and small vessels do not like then to encounter it. So far I agree with him, but I think he has over-rated that difficulty, because it only occurs occasionally. The Tyne Commissioners have done very good work, and they deserve the greatest credit for the spirit which they have exhibited. I think it would have been more impressive if the author had in his paper added

together the amount of the loss last year in vessels and the loss in property on the coasts of the United Kingdom; the two amount to the large sum of 7,340,000*l*. I think that is a very important, and very serious fact. Then, as to the question of the relative value of the employment of convict and other labour, I may say that for the last thirty-six years, without any cessation or interruption, I have had harbour works in course of construction under my direction (I do not say on one harbour, but on different harbours, extending over that long period) by convict labour in different parts of the world. At this present moment there are four Colonial harbours being carried on under my direction, and from my designs, employing somewhere about 1,000 or 1,200 convicts; I therefore know something of the value of convict labour. Under such circumstances, and seeing that it fell to my lot to organize the engineering arrangements for the employment of convict labour in the first experiment that was made in the country—I mean at Portland—I naturally take something more than an ordinary interest in this convict labour question. Colonel Nugent is perfectly right in saying that from the experience at Portland, extending over fifteen years, with an average of 800 or 900 convicts always employed—the number sometimes amounting to 1,200—the average result was that the work got from the convict amounted to about 40 per cent. of the labour of a free man. I see no reason whatever why, under proper management, you should not get from a convict 50 per cent. of the labour you get from a free man. That applies at home. As far as regards the Colonies, where we employ black labour, the proportion is very different. There we find we can get out of the convict very nearly as much as we can get out of the free native. There is one point which Colonel Nugent most properly called attention to, and that is, the propriety of employing convicts on large harbour work, such as he has been treating of. He has said very truly that there is a large percentage of the work to be done on such harbours which does not require that the labourer should be of a skilled class, and, taken as a whole, it is so simple that the men are very easily educated up to the necessary mark. I think he has perhaps scarcely given the convict system full credit for the saving when he deducts the whole value of the prison. If I understand him, he takes the 75,000*l*., the cost of the prison, and deducts the whole value. It appears to me that if a convict prison is set up with the view that the prisoners will only be occupied on a given work for about ten or fifteen years, it might very well be that certain parts might be constructed in iron, and otherwise so devised that portions might be utilized elsewhere. Of course, as he remarks, owing to the increased time taken by the convicts, there would be a very large absorption, in the plant and establishment charges, of what would otherwise be a saving, because it is pretty obvious that in works of this kind the same establishment and arrangements that will suffice for dealing with 1,000 tons per day, will almost suffice for 2,000 or even 2,500. That absorption was felt at a very early stage at Portland; it was one of the points frequently urged upon the Convict Department, that it was most desirable, on the score of economy, to send out from the quarries a constant quantity, or something approaching a constant quantity, that should be about equal to that which the establishment was capable of dealing with. It is rather a common error to suppose that one can state offhand a general rule as to what will be the percentage of saving by the employment of convict labour as compared with free labour. It is not possible to do anything of the sort; it is not possible to say what the result will be in a given place until you have brought all your arrangements into work. There is, I believe, no other class of outdoor work on a large scale which involves the employment of so small a proportion of skilled labour as that of the quarrying operations in connection with harbours of refuge. The only kind of work that can compare with it in this respect would be a fortification on a very extensive scale, involving simply earthworks, or the quarrying of stone on an extensive scale, as at Portland, where we excavated a ditch somewhere about 120 feet wide, and 80 feet deep, with the double object of obtaining stone for the breakwater, and making at the same time a fortification ditch, and I need scarcely say to this meeting a pretty considerable fortification ditch it was. Very shortly after commencing the breakwater in Table Bay, at the Cape of Good Hope, rather more than twenty years ago, the authorities in the Colony realized the great value of the employment of convicts on a

large harbour work at one spot, and for a considerable period of time, as compared with their employment on roads and bridges, which necessitated their frequent removal and the consequent frequent removal of their barracks from place to place at considerable expense and inconvenience. Assuming a saving of 10 per cent. by the employment of convict labour, which you certainly ought to calculate upon, I think it cannot be disputed for a moment that there is a very great benefit in employing convicts upon labour which, properly regulated, shall conduce to their training to habits of industry; and it should also be borne in mind that in works of this class the employment of prison labour cannot for a moment be held to clash with free labour, as might be the case in other branches of industry. This clashing or interference of convict labour with free labour is a point which has been very much dwelt upon in the country on different occasions, but I wish to call attention to the fact that there can be no such interference in works of this class, because they are such as would never be undertaken by private enterprise, and that in that respect the employment of convict labour on these harbours must be held to be altogether free from objection. Adverting to the question of Lundy Island; looking at the changes in steam-ships and war-vessels, I am strongly inclined to agree with Colonel Nugent that Lundy is a very suitable place for the construction of a large harbour, that would be of great value strategically, and as a harbour of refuge. He said Lundy might very well wait; that was pretty much the conclusion which our Commission of 1859 came to. I should like to say a word with regard to the fisheries; a very important matter. The fish which are caught, landed, and sent away by rail only between Whitby and the Humber, if taken at the rate of 1½d. to 2d. a pound, would amount to about 3,000,000l. sterling annually. With regard to the Dogger Bank, there are on the bank three main fishing grounds: one called the "South-West Patch," another the "Silver Pit," and the third the "Well Bank;" these lie in a little group immediately opposite Filey. The boats fishing there now go to Whitby, to Scarborough, and a few to Hartlepool, but the bulk of them under present circumstances go to Hull and to Grimsby. Bearing in mind the frequent difficulties of getting into the Humber by reason of the strong ebbing tides occasionally aggravated by "freshes" or land-floods, the greater number, if not indeed all these vessels, would make for Filey if there were a safe harbour there; and seeing that the produce of these fisheries represents the national food to the extent of about 3,000,000l. at the present time, and seeing also that the produce of these fisheries is increasing year by year, the importance and the advantage of getting the fish to market at the least cost, and at the earliest moment, and therefore in the best possible condition, will be readily understood and appreciated. May I say one word about Tees Bay? As one of the Commissioners of 1859, I think it right to justify their conclusion. The fact is that our labours were devoted in an especial degree to that part of the east coast of which Colonel Nugent has spoken more particularly, and notwithstanding that three of the members, before the inquiry was set afoot, had pronounced a *primâ facie* opinion in favour of Hartlepool and Tees Bay, the result of that long and searching investigation was that the seven Commissioners gave their unanimous opinion that Filey was the best place for a harbour of refuge on the east coast of England.

Major-General T. B. COLLINSON, R.E. (retired): I think myself very fortunate that I have come back again to this Institution after a lapse of some years just in time to hear this important subject brought to the front again, and particularly that it has happened that my friend Colonel Nugent has been the person selected by the Institution to bring it up; for I do not know anybody, from his long acquaintance with this class of question and his practical experience of Portland and the employment of convicts, who is more fitted to bring it to the notice of the Institution, and whose opinions will have more weight. He has alluded to the past discussions at this Institution upon this subject, and it might be thought that we are fighting old battles over again and using the same arguments once more. But I think we must bear in mind that it requires a long series of repeated naval and military operations to get an idea fixed firmly in the British Parliament. It is only by repeatedly hammering year after year in this Institution that we shall really get progress made. We have now got, I am happy to say, a considerable step in advance; and

that leads me to point out another reason why this is a favourable opportunity for bringing forward this subject again; for during the past year there has been sitting, under the direction of the Treasury, a Committee for considering the question of employing convict labour generally, and that Committee has mentioned three places where harbours of refuge might be formed, and which would be very suitable works for the employment of convicts—one is Dover, the second Fife, and the third Peterhead. They have mentioned the two latter chiefly, I believe, because they were suggested by the great Royal Commission of 1859; and the Government, I understand, have gone so far in approval of their Report, that they have in contemplation the application to Parliament for a sum of money to build a convict prison at Dover, with a view of commencing works there. Therefore I think with Colonel Nugent we may fairly consider that Dover is now wiped out of the question, and that the main consideration for this Institution is, where is the next best place to make a harbour of refuge? I think we should take care to separate well the two ideas of harbours of refuge and convicts, and not necessarily confound them together. I say this, for I observe it has been stated before the House of Commons' Committee now sitting upon the subject of the improvement of smaller harbours, more particularly with respect to the fishing interests, that it is necessary to employ the convicts somewhere, and therefore a harbour of refuge ought to be made. Now I think that is rather putting the cart before the horse. The argument for our consideration should be, is it necessary to have a harbour of refuge? and, if so, where? and then afterwards to consider whether it is practicable to employ convicts upon it. There are three distinct points for consideration in dealing with harbours of refuge: the first is the use of them for large vessels passing upon ocean trade; the second is the local trade; and the third is the use of them for war purposes. Now with respect to the first, the great ocean trade, I shall leave it to other persons more capable than I am to give an opinion as to the best position for the next great harbour of refuge, or even whether it is necessary at all to have one for that purpose; for there seems to be, indeed, some doubt on the part of the mercantile marine whether there is any such great necessity. The existing harbours upon the north-east coast have been considerably improved of late years, especially at the Tyne and Hartlepool and the Tees; and I understand, before long, they expect to get a considerable depth of water at each of those places, and although they are not available at all times they probably will be so at most times, not only for large merchant-vessels but also for unarmoured cruisers. But a more important point, I think, than the question of the ocean trade is the fishing trade; and in that I have been particularly interested of late, for my duties in Scotland obliged me to consider the question of employing convicts upon this proposed harbour at Peterhead; and there I came into connection with the fishing population, and learnt something of the importance of that population to the coast defences of this country. It is not merely the question of supplying cheap food. A great naturalist lately made a statement to the effect that, if we can only get a cheap fish supply, the question of the fishing population is a secondary one. I do not think so; the fishing population is a large one, and a very important one for the Naval Reserve. It forms a large and a powerful part of it, and I am afraid there is some danger, if the question of the fishing trade is treated only from the point of cheap fish supply, that it may decrease; for I understand that the trawlers have driven away some of the fishing population from smaller places on the coast, by being unable to compete with them. The fishing population are the peasant farmers of the sea, and it is impossible for them, under the conditions in which their business is carried on, to provide themselves with the necessary harbours for the purpose. Moreover, one great harbour of refuge will not meet all their wants. What they require is, that several harbours along the coast should be improved, because the fishing-boats have to follow the shoals of fish as they move along the coast. That want, of improving the several harbours, will be to a great extent met by the Committee of the House of Commons, which is now sitting, a part of whose consideration is, I believe, to enable the local places to borrow money at cheap rates from the Government in order to improve their own harbours. Another point for the benefit of the fishing population is getting the fish to market easily. For this purpose I quite agree that Fife comes in for very important consideration. It is not only near one of the

great fishing banks, but it is within reach by railway of some of the great centres of population; and on that point I may mention that a fish wharf, established at Hartlepool not long ago by the North-Eastern Railway Company, has grown to very large dimensions, mainly, as I have been informed, because the fishermen say that they can make three voyages from the Dogger Bank to Hartlepool for every two they would make to Grimsby, and therefore they get a quicker market for their fish. But to make Filey properly available for this purpose the railway communication would have to be improved. With respect to the war requirements in connection with harbours of refuge, the only point I wish to draw attention to is the guarding of the coast by cruisers, and the consequent necessity of having coaling harbours for them. There are at present no really good coaling harbours upon that coast. Although the Tyne and Tees may be available to some extent, they are not always so. Now this is a question that tells very much in favour of Filey, because the great trade lies between the Humber and the Tees and the Tyne and the Forth. That is where cruisers would have to be to guard it, and at some points near those centres of traffic you would require to have more accessible coaling ports for the cruisers to resort to.¹ This, however, is quite a distinct question from that of strategical harbours proper. With respect to the employment of convicts upon these works; if Dover is taken up, that will employ a considerable number of men, but still, as I understand, there will be a large number available for other work, and therefore it would be quite possible to carry on a second harbour of refuge at the same time with Dover. It will be a question of getting money to do it, and not a question of providing the convict labour. As the Home Secretary very pithily said with reference to this question, there are several large spending departments of the Government which require a great deal of labour, and there is one department of the Government which has the labour to supply, and the question is to bring them into contact with each other; and, if Parliament would only give the money, that cannot be done in any better way than by carrying on as many harbours of refuge as you have convicts that can be satisfactorily employed upon them. I do not expect there will be much saving to the Government eventually in the employment of convicts, if you take into consideration their maintenance; but then we must recollect that the convicts must be maintained wherever they are; and if we leave out the cost of maintenance and the cost of the necessary prisons, then there would certainly be a saving, by all the experience we have had, of from one-fourth to one-sixth of the cost of free labour. I have only one thing more to mention, and that is with reference to Peterhead. Although the evidence is very strong in favour of having the next harbour at Filey, there has been a great pressure put upon the Government to construct one also at Peterhead, mainly with the idea of employing the Scotch convicts upon it. Now I venture to think that would be a mistake both for the benefit of Scotland and of the country at large. It seems to me to be very doubtful whether it would be advantageous to have a large harbour of refuge at Peterhead. It can hardly be said to be required for the great ocean traffic, as there is very little traffic that goes round the north of Scotland; and it cannot be said to be required as a strategical harbour, because although we are tolerably well agreed about the advantages of having a strategical harbour on the coast of Yorkshire, I do not know that anybody at the present time is strongly in favour of one at Peterhead, or, indeed, any further north than Filey; and it would certainly not be so great an advantage to the fishing population as would the improvement of several harbours along the coast.

¹ In addition to the above, it will probably be interesting to record the following statistics of the trade at the north-east port, as it affects the question of the position of coaling ports for cruisers:—

I. Approximate value in millions of pounds sterling per annum of sea traffic inwards and outwards—Humber, 53; Tyne, 17; Forth, 12; Tay, 4; ports north of Tay, 2.

II. Approximate tonnage in millions of tons per annum, inwards and outwards. This may fairly be considered as a measure of the number of seamen employed—Humber, 7½; Tyne, 12; Forth, 5; Tay, 1; ports north of Tay, 1½.

Sir DIGBY MURRAY, Bart., Board of Trade: There is one point in the lecture which has not been, in my opinion, sufficiently noticed, and that is the distinction between harbours of refuge and life harbours. I think it must be quite clear, at all events Colonel Nugent's lecture has convinced me if I required conviction, that the establishment of a number of deep-water harbours along the coast in various directions, easy of access, and not fortified so as to render them equal to their own defence, would be a source of very great weakness to this country, especially looking to the number of ironclads that would be likely to be available for the defence of the coast in time of war. Every such harbour, if it was not capable of self-defence, would require to be watched, and where are we to get the fleet from to watch them? I think that Colonel Nugent made a proper distinction between a large military harbour which should be capable of defending itself and smaller life harbours in shallow water which might be available for our fishermen to run into in case of need, but which at the same time would not be capable of harbouring an enemy's fleet.

Mr. F. JOHNSON, Secretary National Refuge Harbour Society: At this late period of the discussion I propose only to make a very few remarks. The point I shall allude to particularly is the question of convict labour. I think it is beyond all dispute that harbours of refuge are needed; the question is, how are we to get them? We have but three resources, the first is by Government grants, the next is by national loan, and the third by convict labour. In the present state of public opinion it is quite clear that we are not likely to get anything by public grant. If you are to get any harbours generally round the coast there is the very greatest difficulty in getting them by public loan, and for this reason Government has already decided that it does not wish to interfere with the Loan Commissioners. The Loan Commissioners are responsible for the money which they lend, and they do not wish to make any bad debts, and therefore in places of the greatest necessity it is impossible to get a loan as they cannot give approved security; the consequence is we are entirely left to convict labour; we have no other present resource. There is no question about it. The resource which is left is an inferior one, and one that, by itself, we cannot expect to get a very large amount out of, but as it is the only resource we naturally fall back upon convict labour. Now, we were told the other day by Mr. Chamberlain that it was from the ranks of the fishermen that we obtain British seamen, who are the defence of our Kingdom, and I think, considering that we have drowned in the last twenty-four years 20,000 men, one of the greatest strategic problems we have to face is how to preserve as large a number of these lives as possible to oppose any enemy which unfortunately might threaten us. Colonel Nugent tells us that on the French coast they are making important harbours, and are setting us an example; but there is one point must not be lost sight of, and it is this fact, that the whole of the harbours on the French coast are State property, which is not the case in our own country. It certainly is a thing which has impressed itself upon my mind that we should have to take an example in that respect from our neighbours the French, because at the present moment almost every locality is doing everything that it possibly can to get its own members of Parliament to advocate its own particular personal interests, and as long as it is advocated in that way the national point of view is set on one side, and after the Committee which is now sitting in the House of Commons has completed its task we shall have the whole of these particular interests that have been promoted by constituents, and not from a national point of view, brought forward, Government will be embarrassed, and we shall be placed in the same position that we were in some twenty-three years ago, when the last Royal Commission sat upon this question.

Admiral BOYS: Had time permitted I should like to have made a few remarks on the subject of the paper. I will now only detain you one or two minutes. I have had the pleasure of being associated with Sir Charles Nugent for some years on duty of different kinds, and I know that there is no one that the Council could have selected who would have been better able to deal with this subject. There is one condition of a harbour of refuge which appears to me has not been referred to. It is that we must not consider that a harbour of refuge is only a harbour for our mercantile navy to resort to in case of stress of weather or on account of being disabled. It is very probable that in the future, should we unhappily be engaged in

war, that an enemy's cruiser, like the "Alabama," might drop on our coasts unawares, especially on our exposed east coast, with the object of destroying our coasting trade and shipping. Then, what are our vessels to do? They will have to make for the first place they can reach to seek for protection, and that must be a harbour where their enemy cannot follow them. It appears to me on the east coast Filey is exactly that place. With regard to the question of the Tees *versus* Filey, I would simply point out that the subject of this lecture is harbours of refuge in connection with convict labour. It is clear the mouth of the Tees is not a suitable locality for a convict establishment. If Filey did not exist, then I should say let us have a harbour of refuge at Tees Bay; but as Filey does exist, it is, in my opinion, unquestionably the best position for a harbour of refuge on that coast.¹

The CHAIRMAN: Before asking Colonel Nugent to reply I wish to make one very brief remark, although it refers to a point that has been touched upon by Sir John Coode. I do not think Sir Charles Nugent's description of the Tyne is quite accurate in the present day. The Tyne Commissioners have spent very large sums of money in improving their harbour, and it is hardly accurate to call it a "narrow outlet of a small river, and no vessel could attempt its entrance in certain weather, or could remain in it if it succeeded in entering." Now, as to the entrance to the Tyne, there is never less at the lowest spring tide than 21 feet of water. I think it is a very fair harbour if a navigator knows his position, and is brave enough to run straight in for it with an easterly gale. Of course, a steamer might do that with more impunity than a sailing vessel, but I thought it only fair to the Tyne Commissioners to mention that their harbour is now a very fair harbour, with 21 feet as the least depth at the entrance. I was also going to ask Sir Charles, although it is perhaps hardly fair to ask him to undertake any further labour, whether he could by any means put a little more prominently than he has done the number of ships actually lost on the east coast as distinguished from those that are injured by collisions. As I understand from the figures he has brought before us, and they are very formidable in any way we take them, a great number of the casualties are collisions, and of course have no connection with the question of harbour or no harbour. With these few remarks I will now ask Sir Charles Nugent to reply.

Sir CHARLES NUGENT: I will endeavour to reply as briefly as I can to such observations as have been made upon the paper which forms the subject of our meeting. Some of my hearers, perhaps, did not understand that, practically, the paper only dealt with one class of the harbours which formed the subject of the Report of the Royal Commission of 1859. It seems to me that with a view to define their ground clearly, they made, I will not say an unwise distinction, but a distinction which had not previously received acceptance, and that what previously had been generally understood by Harbours of Refuge, viz., great harbours which ships might make for at any time and in any weather, they do not call Harbours of Refuge. Indeed, I have often been puzzled in reading their Report to keep the facts of it clearly before me, my mind so far having been prejudiced by the common acceptance of the term Harbour of Refuge.

It is perfectly true that much time will be expended if we employ convicts, and looking at the matter at the present time, and feeling how great the need is for harbours of refuge, it, no doubt, seems hard to have to wait, but I fear that that is almost inevitable, and as we have waited in the past, and have after all obtained the result we so much desired, I can only counsel patience in this matter. Captain Swinburne referred to the Tees. I can only say, I am not a

¹ Had time permitted I should have said that I could not agree with the proposal for a harbour of refuge at Lundy Island. It is situated in the midst of the strong tides of the Bristol Channel, surrounded by tide races, which any solid structure in the water would increase and make it too difficult for disabled ships to enter, besides it would be cut off from all outside resources, which is made a necessary condition for a harbour of refuge. With Dover in hand and Filey to come I think we may well leave the question of Lundy Island to be discussed and decided by another generation.

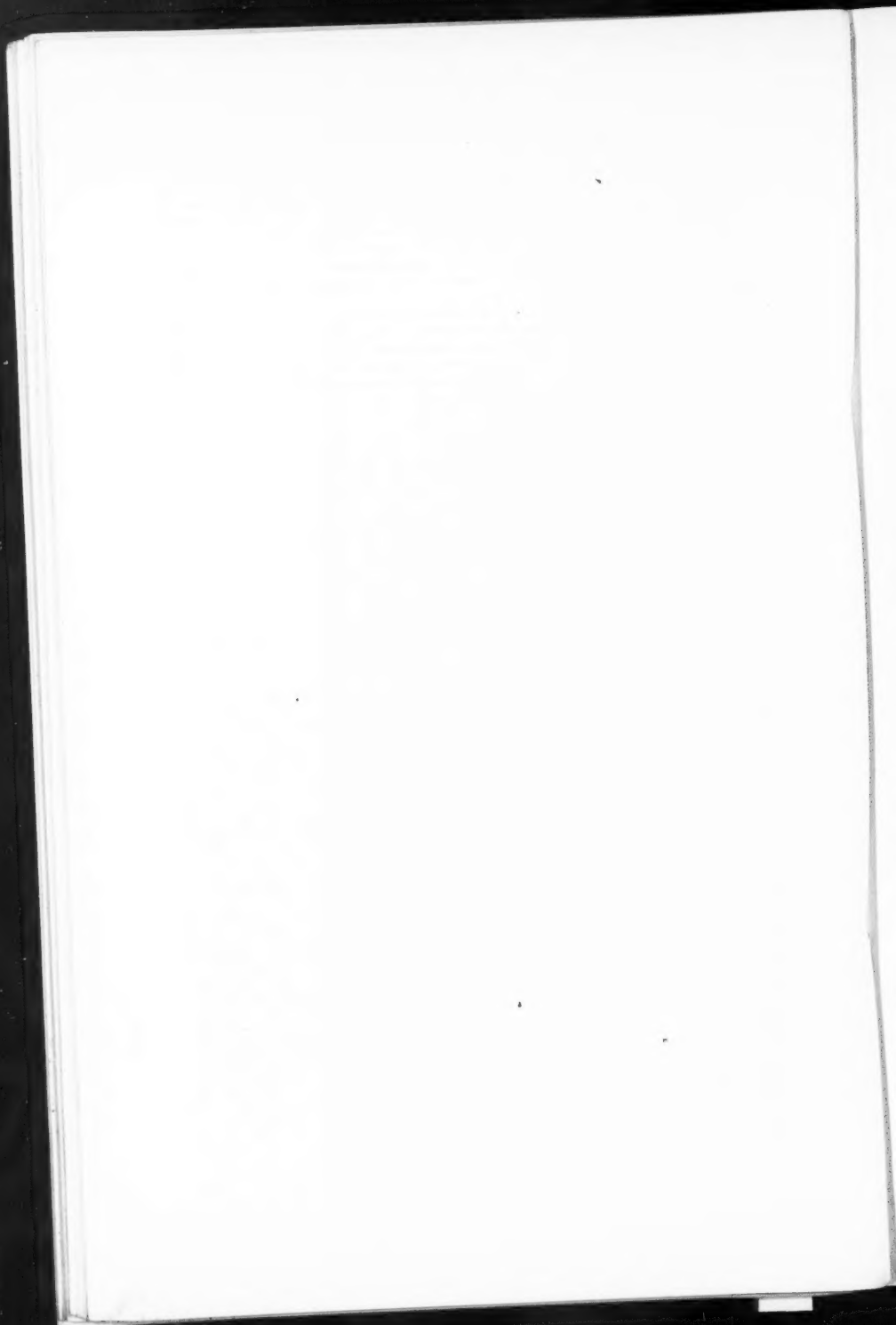
nautical man, and my opinion is not worth much, still I had the good fortune to be associated in the examination of that coast with several very able seamen, Admiral Phillimore, Admiral Boys, and Sir Digby Murray, and others, and although we were able to devote but a limited time to the investigation of some of the Harbours, yet I believe we went to them all. I afterwards went down to examine them myself alone, and my opinion coincides with that of Admiral Boys, who said that Filey is far beyond Tees Bay or Sunderland. In reply to Admiral Ommanney it may be that at the present time convict prisons afford us no good return, and personally I am unable to say what good we have got out of Dartmoor Prison beyond the penal restraint of the prisoners. As far as labour for the nation is concerned I cannot say that we have got much; but I have no experience in this matter, and I did not enter upon this subject with any intention of taking it up. My object was not to show what could be done with prisoners everywhere or how they could be best treated, but simply to point out that certain forms of labour, such as harbours of refuge, were very suitable for the application of prison labour. I would stop for a moment to say how very kind it is of Sir John Coode to speak of me in the flattering way in which he has done, and it is a real pleasure to me that after some years of separation he should retain so kindly a remembrance of me. I am bound, also, to say, that with regard to General Collinson, he has spoken of me in far too favourable terms; indeed, both he and Sir John Coode unwittingly were praising themselves, for, as I have already told you, I have availed myself largely of their labours in this field, and no doubt much, perhaps most, of what is good in my paper comes from them. Sir John Coode did in a certain measure answer Sir Frederick Nicolson, for he said of the Tyne, that with a heavy tide and strong easterly gale you could not make the harbour.

Sir JOHN COODE: Not quite that you could not make the harbour, but that it was very awkward for a small vessel to make.

Colonel NUGENT: I accept the correction, and am also very glad to find that Sir John Coode's experience in the employment of convict labour so much agrees with mine. Of course labour of this kind should not be placed in competition with free labour, and he very early made a point which I had omitted, and that is, that this very form of labour is the form of all others which does not clash with free labour at all. With regard to the remaining value of the prison buildings after the harbour works are completed, I agree with Sir J. Coode that it would be considerable, and should be taken credit for. I purposely abstained from taking credit for it, because such buildings are not useful for general purposes, and I was anxious not to state the case too favourably for the employment of convict labour. While I entirely agree with General Collinson as to the extreme difficulty of influencing the British Parliament, in which conflicting interests are so powerful, I hope with him that Dover is happily wiped out of the question. As to Peterhead, as far as I can judge, the class of trade carried on there does not justify a great national harbour, and strategically I cannot see the use of it, but I entirely concur with him in the importance of this matter to the seafaring population. Moreover, I think the only partial success, if I may say so, of the Naval Reserve, with reference to which the seafaring population must be an important element, is an additional reason why we should not lose sight of that population, but I am afraid that any attempt to keep the members of it spread all along the coast, as I understood was General Collinson's inclination, must fail, for the seafaring population will follow the law of supply and demand. If the trawlers push the seafarers, the peasant-farmers of the sea, out of the market, the seafarers will have to accept their fate, and the smaller harbours must dwindle. Sir Digby Murray referred to my want of distinction between harbours of refuge and refuge harbours, but I said at the outset of my paper I only dealt with the one description of harbour, and that I should devote very little consideration to the other, and that the particular description of harbour would be termed by me for my purpose harbour of refuge. In reply to Mr. Johnson, I think possibly we shall have to fall back on convict labour. Public grants or funds issued by the Loan Commissioners are much more hard to get. I meant to have mentioned the condition of harbours of refuge which Admiral Boys touched on. However, if I did not do so, he has laid it very clearly before you. If I ventured to differ at all, I

think I should be inclined to differ a little with Sir Frederick Nicolson about the Tyne. What I had in my mind was that it was not by any means a sort of harbour which any large vessel, not thoroughly well knowing its position, would care to make in certain weather. I spent a considerable time there, and had the advantage of having official information of what has been done by the Tyne Commissioners, and I am perfectly aware of the noble efforts which have been made, and the very large expenditure they have incurred. I have only to thank you for listening to me so patiently.

The CHAIRMAN : I have only one other duty to perform, and that is to return our grateful thanks to Sir Charles Nugent for this very able and interesting paper. It is manifest from the mass of figures and diagrams he has brought before us that he has expended a very considerable amount of labour in preparing his lecture, and I am sure we are all deeply grateful to him for bringing it before us.



Friday, June 15, 1883.

ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B.,
Vice-Chairman of the Council, in the Chair.

MACHINE-GUNS.

By Captain Lord CHARLES W. D. BERESFORD, R.N.

THE CHAIRMAN: Your Royal Highness, Ladies and Gentlemen: It is with very great regret I have to announce that Lord Alcester, in consequence of indisposition, is unable to take the chair this afternoon. I am very sorry for that on many accounts; especially because his Lordship, as we all know, commanded the fleet when the forts of Alexandria were bombarded, on which occasion machine-guns played an important part. I have been asked to take his place, which I do solely in consequence of my official position as Vice-Chairman of the Council, and not as having any particular knowledge of the very important question we are about to discuss. I have now only to introduce to you Lord Charles Beresford,—if any introduction is necessary,—who, as you are well aware, commanded an active little vessel on the occasion of the bombardment of those forts, and who is good enough to bring before us this very important subject.

FOR a number of years the machine-gun question has been constantly brought before the Royal United Service Institution, and many arguments have been used by some of the cleverest Officers in both Services as to its merits and demerits.

Inventors and machinists have shown the working and the terrible capabilities of their guns, and although the general consensus of opinion, as gathered from reports, appears to be largely in their favour, still, from some cause or another, their immense utility and fearful powers do not appear to be appreciated as much as they would seem to deserve. I propose in the first part of this paper to devote my remarks to machine-guns as applicable to the Naval Service, also to those mercantile ships which, if properly armed, would form such a large and invaluable contingent to the Navy in the event of a war with a European Power. In the latter part of the paper I meant to have added a few more observations to the many that have been made by others, as to the utility of having machine-guns mounted in the field, but time will not permit of my doing so. I am most anxious that my views should be conveyed in the most unprejudiced manner, as to which of the many machine-guns is the best, or in other words combines the greatest number of advantages in its practice and working with the fewest disadvantages, and if my remarks appear to favour one machine-gun system more than another, I hope the reasons given will be most fair, clear, and satisfactory, and not regarded as criticisms on the inventors.

By the 31st March, 1884, the Navy will possess 565 Nordenfelt machine-guns of 1-inch calibre, throwing a solid steel bullet, and principally useful for repelling torpedo-boat attacks; added to this, on

the same date the Navy will possess, or should possess if the contract be fulfilled, 350 Gardiner machine-guns, .45, or rifle, calibre, throwing lead bullets. These numbers, added to the 142 Gatlings already in the Service, will make up the total number of 1,057 machine-guns for the Fleet, amongst which not a *single* shell machine-gun is included. It is proposed to add a large number of quick-firing 6-pr. guns to the armament of the Fleet, and a most excellent proposition it is, as it will do away with the multifarious guns, with their several kinds of ammunition, of all calibres, sizes, and different systems of loading, at present existing in the Navy, and ranging from the 7-pr. to the 12-pr. These last-named guns are all useless for torpedo or other attacks of the present day, owing to their slow firing and equally slow, cramped training, as well as to the bad trajectory caused by their low initial velocity, and their day may be described as past now that the advent of the quick-firing 6-pr. breech-loading gun is so close at hand. A 6-pr. breech-loading gun cannot, however, be described as a machine-gun proper, for the simple reason that the charge is too large to avoid recoil when fired, and recoil means relaying the gun by the sights after each round. A machine-gun proper should have no recoil, and should also be heavy enough to resist any great vibration after being fired, so that the sighting cannot be affected by the discharge of the piece; and when once the gun is laid for an object, the man firing it should be able to fire round after round with the greatest rapidity, and as long as his sights bear, each round would hit the object aimed at to a certainty. The new 6-pr. is, therefore, very properly called a quick-firing gun, and not a machine-gun, and it may be dismissed from our attention at present, as, although it is of the utmost necessity that this gun should at once have a prominent place in the armament of the Navy, and be placed in all ships, particularly small ones, and, further, that a large store of them be kept to arm merchant vessels in case of war, still I do not consider that they can be mentioned fairly in a paper devoted to machine-guns for the reasons already stated.

The danger to the ships of our Fleet cannot be exaggerated if a sudden war broke out, and England had to face a Fleet or possibly combined Fleets of foreign nations, more particularly if the French Fleet was one of those opposed to us. In some classes it is quite undeniable that the French have a better vessel altogether than the English; in all classes they are better gunned, as not only have they the enormous advantage of breech-loaders, but their guns are vastly superior to the English in penetration and rapidity of fire per weight of gun. When comparisons are made between two guns, having nearly the same calibre and weight, these two qualities (the rapidity of accurate fire and great penetration) are the most important to consider; while to add to the advantages named, the French have mounted in their Fleet between 600 and 700 Hotchkiss machine-guns, throwing 1-lb. shell at the rate of fifteen to twenty a minute. Most of these guns were mounted in position in their Fleet before the English had any sort of machine-gun whatever, and some were bought as far back as the year

act
ng
in
or
ed.
he
it
of
at
or.
of
ed
ial
nt
A.
e-
id
ts
nd
ng
he
it
nd
to
k-
m
es-
he
all
nt
n-
ns

a
ly
ch
te
he
ey
ly
er
s,
es
st
d,
00
en
on
e-
ar.

THE NORDENFELT 1½ INCH MOUNTAIN SHELL GUN.

FIG 1. Side View of Gun and Carriage.

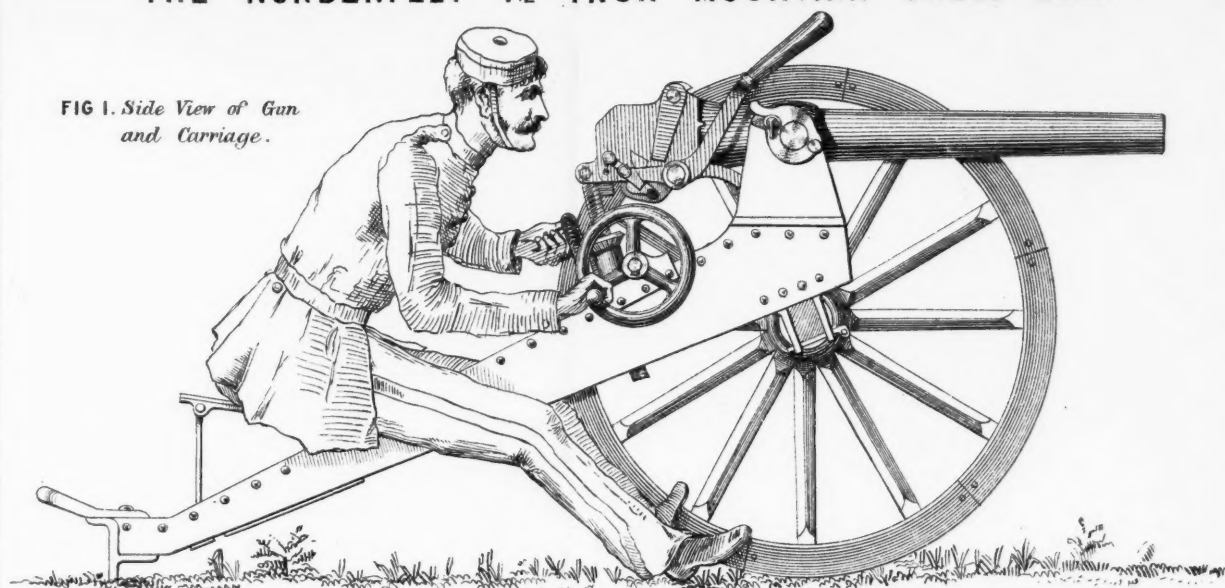
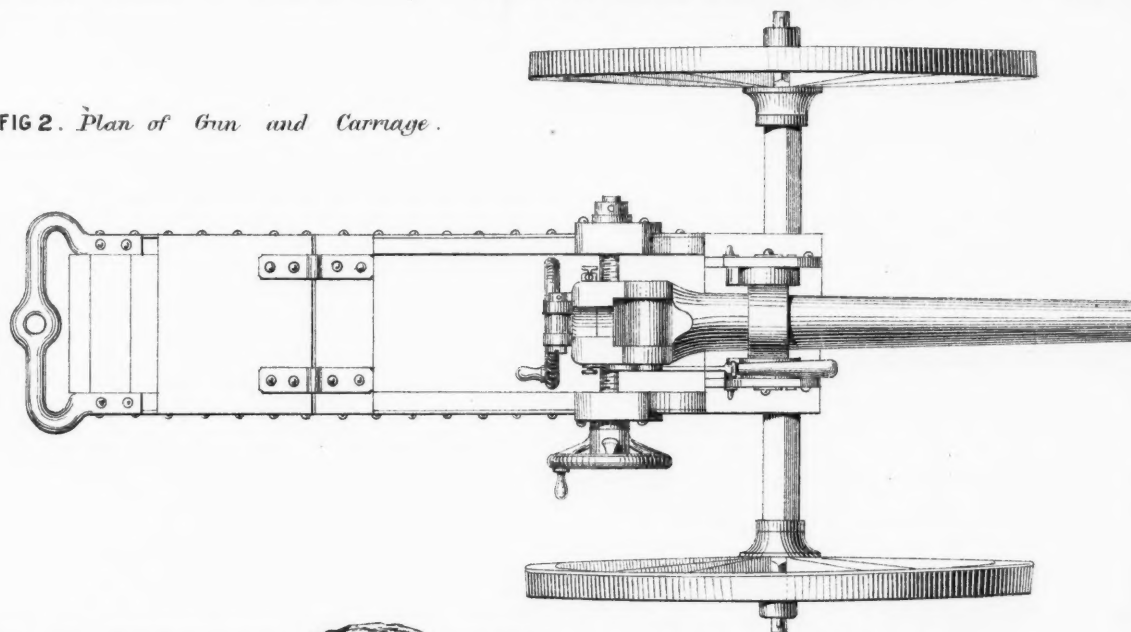


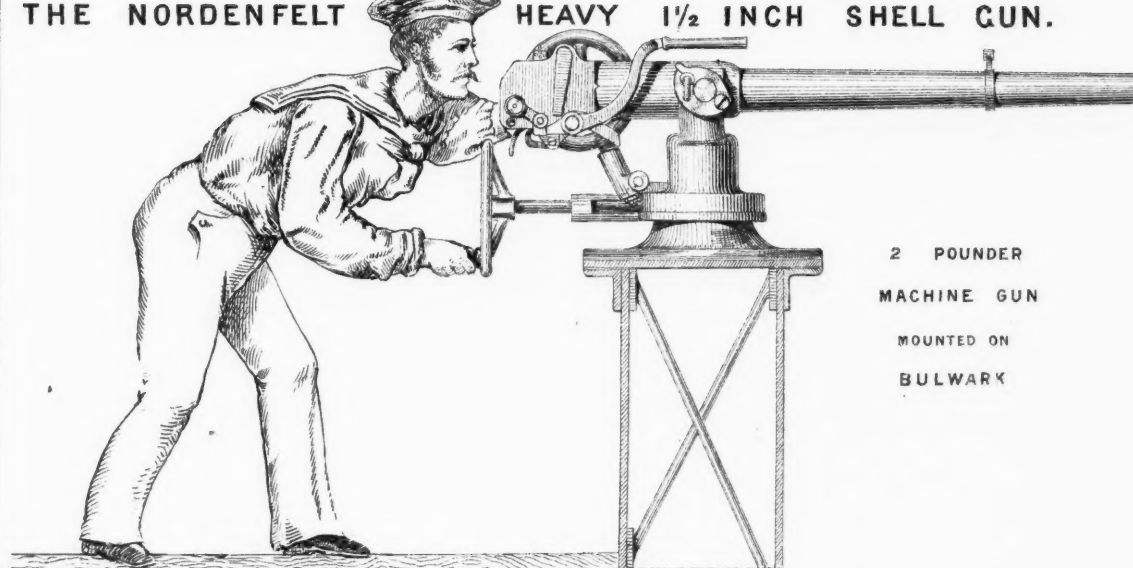
FIG 2. Plan of Gun and Carriage.



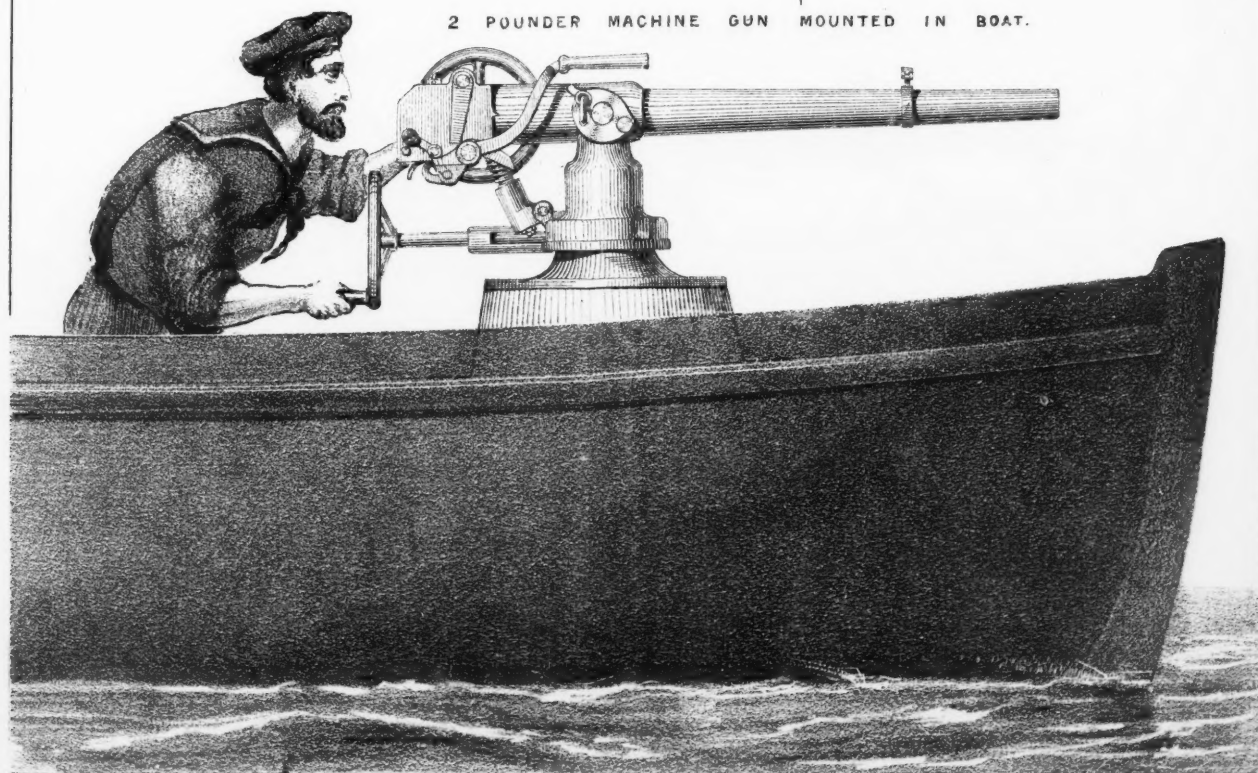
THE NORDENFELT HEAVY 1½ INCH SHELL GUN.



THE NORDENFELT HEAVY 1½ INCH SHELL GUN.



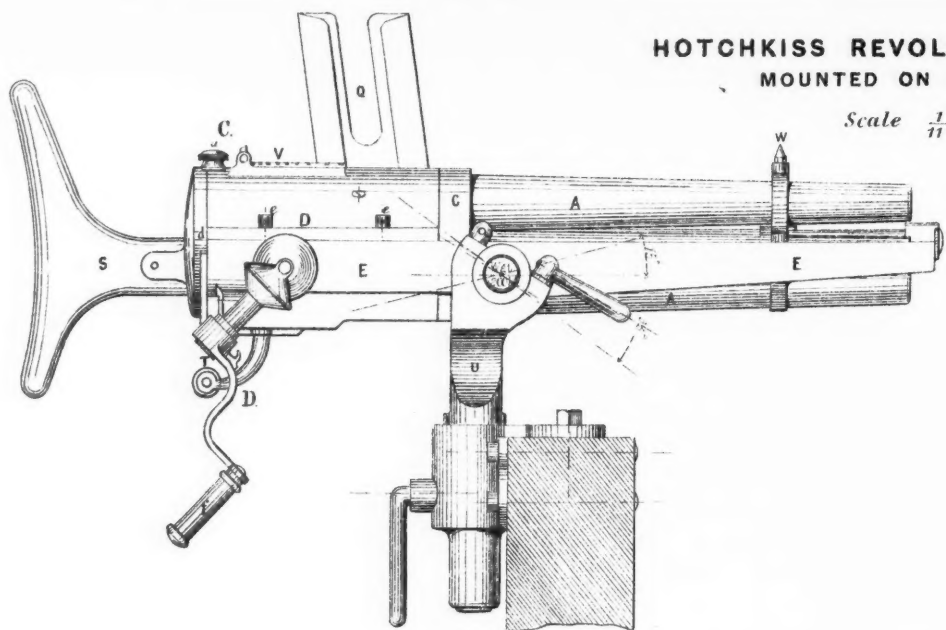
2 POUNDER
MACHINE GUN
MOUNTED ON
BULWARK



2 POUNDER MACHINE GUN MOUNTED IN BOAT.

HOTCHKISS REVOL MOUNTED ON

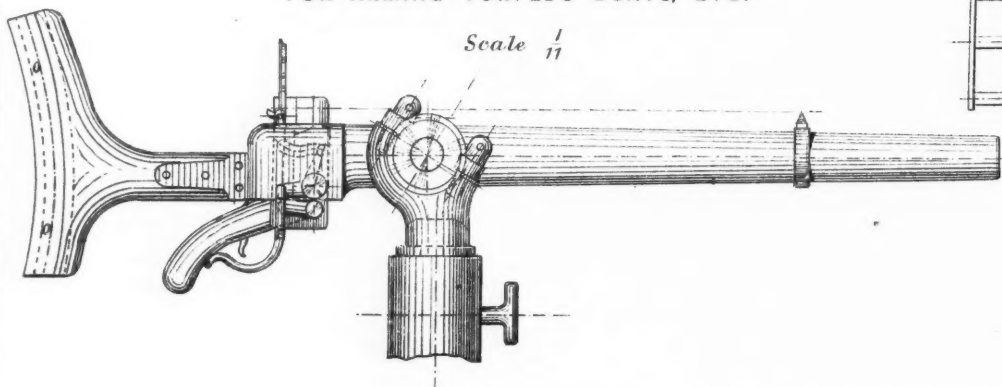
Scale $\frac{1}{11}$



Elevation

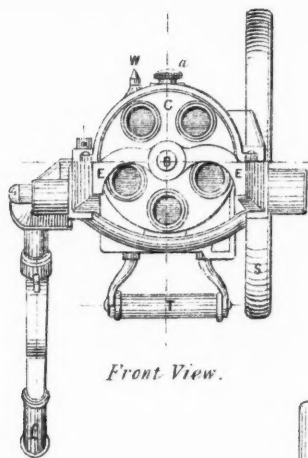
HOTCHKISS ONE POUNDER RAPID-FIRING GUN FOR ARMING TORPEDO BOATS, ETC.

Scale $\frac{1}{11}$

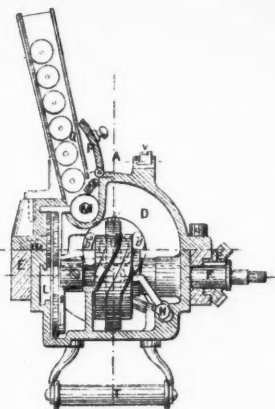


REVOLVING CANNON,
MOUNTED ON BULWARK.

Scale $\frac{1}{11}$



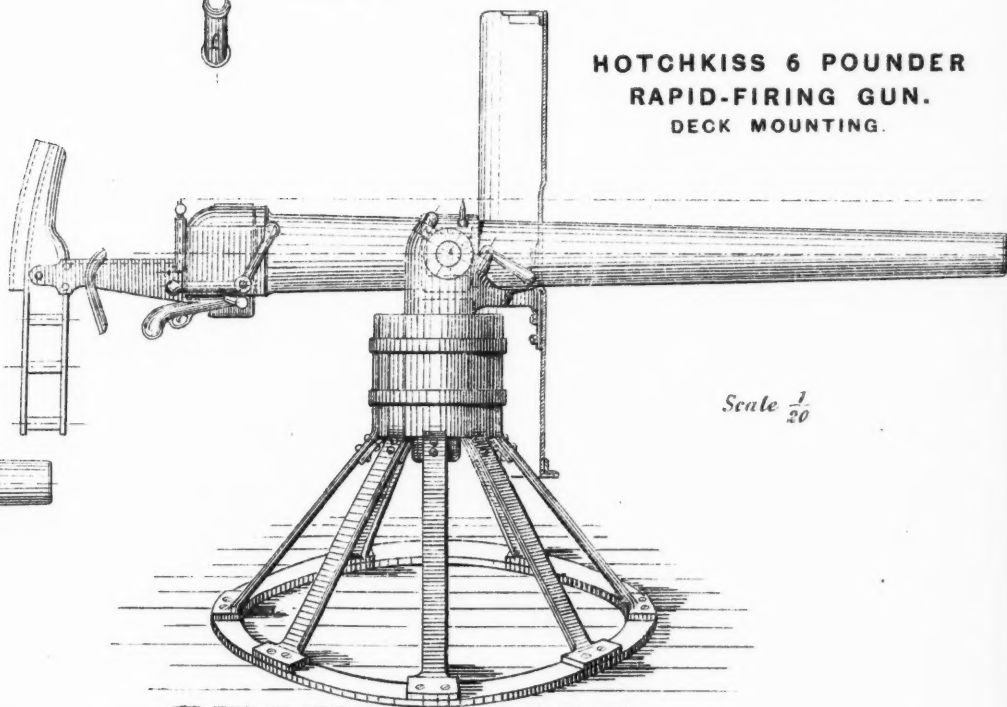
Front View.



Section through C.D.

HOTCHKISS 6 POUNDER
RAPID-FIRING GUN.
DECK MOUNTING.

Scale $\frac{1}{20}$



18
no
th
ov
th
be
in
F
th
k
in
sl
g
h
c
s

t
n
t
t
n
c

1875. The English had no machine-gun at all till 1878, and have no *shell* machine-gun at this moment. It is needless to point out the superiority that a machine-gun throwing shells would have over the machine-gun which only throws bullets, excepting in the case of resisting torpedo-boat attack, when the bullet-gun is better. The proportion of machine-guns between the two Fleets in another two years may be about two to one in favour of the French, if the present relative rate of progress is kept up, as they determined two years ago to double the complement of Hotchkiss shell-guns to each of their ships. It may be stated here that in all the French *small craft* they have two or more machine shell-guns, whereas the English small craft last year had no machine-guns of any description whatever. The French *small craft* are, however, so vastly superior to ours in fighting capabilities that there could be no doubt as to which would win an action if two ships of similar tonnage were engaged.

The disproportion between England and France, however, in the machine-gun question is still further increased to England's most dangerous disadvantage by all the French machine-guns throwing shells, whereas the English have no machine-guns except those firing bullets. Putting aside the other advantages which all naval Officers will readily allow the French have over us in matters connected with their Navy (but which we hope will decrease as new ships are built and new guns supplied), it is impossible to glance lightly at the question of machine-guns throwing shell. Take two ships at present in Mediterranean waters, the "Amiral Duperré" (French) and the "Alexandra" (English). Suppose the questions of speed, helm, and gun are equal, the "Duperré" will have the tremendous advantage of twenty machine shell-guns, each gun capable of firing fifteen to twenty rounds a minute, and each round being a 1-lb. shell; while to these the "Alexandra" can only oppose eight machine-guns, not shell-guns, but throwing bullets. It must be remembered that guns throwing bullets, though invaluable for repelling torpedo attack for reasons presently shown, are of little use for firing at a ship, or at any great distance, *because the effect of the shot cannot be seen* and therefore the *range cannot be found*, whereas with the shell-gun the range should be got accurately in the first three shots, as it can be seen where the shell bursts. Think of the disheartening and terrible moral effect upon men who whilst they find the enemy improving in accuracy every *second* (there are no minutes in machine-gun fire) cannot themselves see what they are doing, and have no possible means of knowing whether they are firing too high or too low, or where their bullets are going. Likes must be met with likes, and machine *shell-gun* fire from an enemy must be met with machine *shell-gun* fire from us. Bullets are of no use for this purpose for the reasons given.

The French also go on the principle of exposing their machine-guns with a view to getting an all-round and continuous fire, whereas the English prefer protecting the men and guns, and consequently the guns will only bear on a certain small arc. This question is open to

argument, and must necessarily be a compromise whichever plan is adopted. In a duel between a gun having an all-round fire, and a protected gun, with the all-round and continuous fire which is gained by risking exposure, it would be possible to put the protected gun out of action before it has had a chance of firing a shot at its adversary, the protection limiting its training and preventing the gun's crew from seeing the enemy or getting their gun to bear. On the other hand, the exposed gun may be put out of action the first shot, or the crew disabled, but look at the amount of damage they may have been able to do before that contingency occurs, even if it does occur! It is certain that a rain of machine-gun shells will do more to demoralize a ship's company than a few heavy shot or shell striking, passing through, or shrieking over a vessel, the demoralizing effect of hundreds of these little shells over, in, and about the vessel is very easy to perceive, for all their actions are calculated to upset the nerves of even the steadiest men. The noise of their explosion on hitting the side or the ship inboard, the smoke attending the explosion and the fragments flying around, the shells being poured in perhaps at the rate of three or four in a second, would surely make the most confident and gallant amongst the Officers and crew feel that machine-guns of this description will probably, or it may be said will certainly, seal the fate of an action; add to this the fact that we have muzzle-loading guns, and that some or all of a gun's crew may be put out of action by one or more of the small shell entering the port, also the extreme probability of one of the very heavy charges of powder used now-a-days being ignited by one of them between decks; now combining all these not only very possible but very probable disasters, am I wrong or do I overstate the case when I say "the danger to our fleet *cannot be exaggerated* if a sudden war were to break out and we were found without any machine-guns throwing shell belonging to us?" I have no fear of contradiction in the strong statement I have just made, as I am convinced that nearly all, if not quite all, of my brother Officers recognize the *immediate necessity* of adding an extensive number of machine shell-guns to the armament of the Navy, if only to keep us on *equal* terms with our neighbours. As it is of no use making strong statements unless something is proposed which may remedy the state of affairs to which attention has been called, I will now make some proposals, and give a reason for each proposition which I sincerely hope may be clear and acceptable.

A large quantity of machine-guns capable of throwing a 2-lb. shell should be at once *added to the armament of the Navy*. The number of 1-inch volley-firing Nordenfelt machine-guns should be increased to double the number (565) which we are to have by 31st March, 1884. I believe this latter proposition is going to be carried out as soon as the over-economical allowance to the Admiralty will admit of it; but this addition of 1-inch guns is not just now so all-important to the Fleet as the shell machine-gun, about which there is no suggestion to procure any for the Navy at this moment. The 2-lb. shell-gun should have the following qualifications: it should have great initial velocity and great penetration; the shell should be fused in the base and not in the head,

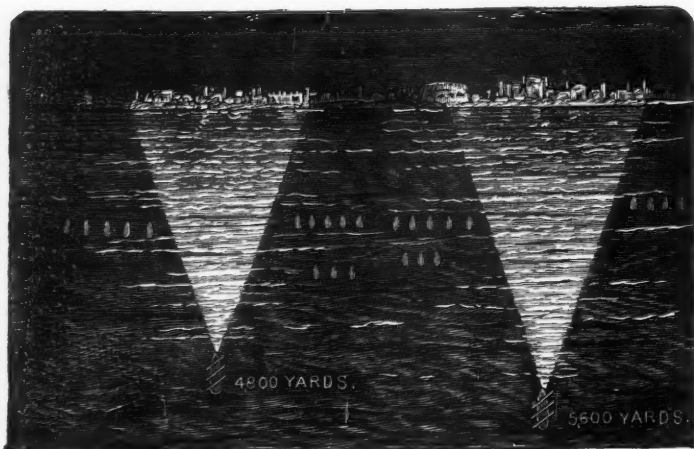
so as to leave the point of the shell clear for penetration; the gun should be a single-barrelled gun, so as to be light and easily moved and shifted as wanted; it should have as far as is possible an all-round fire, with perhaps an umbrella-shaped screen over the men, to keep bullets and shell-splinters clear of them, and from under which they can see the enemy from any point of the compass. Men that are hidden won't fight; they must see what is going on to work well, and more particularly with these guns, if they are to be thoroughly effective. Lastly, it is imperative that the man who sights the gun should be able to fire it, as the eye and hand must work together: grouse would have a cheery time of it if they were attacked by two men, one to hold and lay the gun, and the other to pull the trigger. You want to keep hitting the enemy as rapidly as is possible, and therefore your gun should be mounted so as almost always to be able to bear. The advantages of this all-round fire are very apparent, whereas with a gun protected, it means a very cramped arc for training and a reduced possibility for the men to see what the enemy is doing. Nothing is more disheartening or demoralizing than being fired at without the chance of returning the fire. In support of the argument as to the advantages of an all-round fire, it may be mentioned that at Alexandria the "*Téméraire*" fired a great many more shots per heavy gun than any ship in the fleet, owing to her barbette principle. The French give it as their opinion, founded upon actual practice, that the proportion of hits between a barbette and a broadside ship, coming into range, passing at 60 yards, and going on out of range, is 3 to 1 in favour of the barbette. This is a subject for serious consideration in these days when one shot may win an action.

The reasons for advocating a 2-lb. shell-gun are: 1st, it is the best sized machine shell-gun, as it does not recoil even when on its landing carriage, and it has better penetration than the $2\frac{1}{2}$ -pr., and equally good penetration with the 4-pr. tried at Portsmouth, with lower initial velocity, both of which guns are considerably heavier; 2nd, it is better than the 1-pr. because the 1-pr. common shell cannot penetrate unarmoured ships at 500 yards, or at any angle, nor can it penetrate a gun-port thicker than $\frac{1}{2}$ inch, even at close range. The French, Danes, and others adopted the 1-pr. from economical reasons, because they thought that it would be a machine-gun that would answer *all* purposes, *i.e.*, repelling torpedo attack and firing into unarmoured vessels, and unarmoured parts and ports of armoured vessels; and although it is a very useful gun indeed to them (particularly as we have not one of a similar nature to reply to it), still it has the fault of want of penetration at angles and certain distances; and it is not as good as a volley gun for defence against torpedo-boat attack, as will afterwards be explained. The 2-pr. shell did penetrate at the Portsmouth trials $2\frac{1}{2}$ -inch iron at 300 yards range, and can therefore be relied upon to penetrate unarmoured vessels, gun-ports, &c., at any angle or range for which it is likely to be required. But whatever may be said against the 1-pr., the French adopted it in large numbers in 1875 as being the best shell machine-gun known at the time, and they are therefore dangerously ahead of us in offensive and defensive power at

this very moment. They are experimenting now on a gun throwing a heavier shell, and if satisfactory, will no doubt adopt it.

If the 2-pr. shell-gun is supplied at once to our Fleet, it will fill up a dangerous gap in our armament; it will give us a better gun than the French have of the same class, and the best gun possible in the important particulars of initial velocity, penetration, and accuracy, and above all in the immense advantages of simplicity of working and in its being far lighter in proportion to its utility than any shell-gun whatever. It will give us a gun by which we can always ascertain the range, both by day and night, than which nothing can be more important. It will give us a gun whose moral effect against men I have endeavoured to explain. It will also give us a gun which cannot be equalled in utility for arming small vessels and mercantile ships, as it can penetrate all unarmoured vessels and make itself considerably disagreeable inside. We have a 2-pr. gun at this moment in the country combining every one of the conditions named as necessary, which has been thoroughly tried and highly approved of, but as it costs MONEY we may be years before we get it.

Annexed is a sketch of the way in which the French fleet attacked Sfax, and which cannot but commend itself to our admiration. The large ships could not get in closer than is shown because of their draught. The boats were sent in at night, armed with the Hotchkiss 1-pr. shell-gun; they were perfectly hidden from view by the darkness caused by the counter-effect of the electric light, which was thrown upon the shore by the ships. They could also always shift their bearings and distance at any moment, so that only a chance shot could hit them; but they could always get their own range, because they saw where their own shells burst on shore. Sfax was taken and the forts silenced by the Hotchkiss 1-pr. shell-gun. We have no similar gun in the English Navy.



I will now turn to the question of the best gun for torpedo-boat attack, and give reasons why it is thought the best. I believe there is no gun at present invented which is better for repelling a torpedo-boat attack than the 1-inch Nordenfolt, of which we are to have 565 by the 31st March, 1884, but we ought to have, as said before, double that number.

The advantages of this gun consist in its simplicity of firing and working; in its throwing steel bullets, and in its firing volleys; also in the ease with which the same man who lays the gun by its sights can fire it the instant that they bear on the object. All these are most important points for repelling torpedo-boat attack. The action is simplicity itself; pushing the lever forward loads and fires, while pulling the lever withdraws the empty cylinders. A ship is an unsteady platform which a torpedo-boat would attack at great speed. For a shot to be effective and to stop the boat, the moment of getting the sights on *should and must be* the moment of firing. With this gun the man sighting it can fire at the moment. This is barely possible with a gun whose mechanism is worked by a revolving action, and he has the considerable advantage of firing a volley; the volley of steel bullets is better for stopping a torpedo-boat than a shell, as each bullet has, after penetration, greater wicked energy for mischief against the boiler and other vital parts than the fragments of a shell, and being fired in a volley there is more chance of one or more of the shots hitting than with shells which are fired singly.

The French have given orders to rapidly increase the complement of Hotchkiss shell-guns they possess, as they find they are not suitable against torpedo-boat attack unless used in large numbers, although they are at the same time trying heavier shell-guns of other patterns.

The foreign machine shell-guns are fired by a revolving key, which is a far more difficult principle for a man to work and fire instantly when his sights are momentarily on. Revolving machine-guns are excellent in their way, and we owe the father of them, Dr. Gatling, a great deal for his most valuable invention, but their principle invites an accident, they have to do five things nearly simultaneously, any one of which by going the least bit wrong interferes with the other four, and the gun is instantly out of action; the five things are:—revolving the lever, revolving the barrels, loading the gun, withdrawing the empty cylinders, firing the gun, all to be done nearly simultaneously. It is not my intention to enter into a criticism of the different mechanical inventions, but rather to point out, as I said at first, the class of machine-gun which we in the Navy think combines the greatest advantages with the fewest disadvantages.

We will now turn to the third class of machine-gun which is necessary for the Navy, the "Gardiner" and of which we are supposed to get 350 by 31st March, 1884, to add to the 142 Gatlings we have already in the Service.

All Officers of both Services are unanimous in their opinion that a rifle calibre machine-gun should throw the same ammunition as is used by the Infantry; this should be the first, foremost, and imperative consideration. Nearly all the foreign nations have avoided the

expense, and shirked the necessity for these guns by having magazine-rifles on board ship. We have, however, a number of rifle-calibre guns on the Gatling and Gardiner principle, of which the old pattern Gatling has been very serviceable to the Navy on many occasions, although, being an early invention, its mechanism has been far from perfect, and it has through this defect undoubtedly often failed. A new Gatling with the very best system of feeding has been invented (see Plate), and is believed to be perfect, but it must have the disadvantages that have been mentioned as being inseparable from the revolving system, and it cannot have the enormous advantage which lightness must be to a gun of this description. The rifle-calibre gun has many uses for the Naval Service. It is a manslaying gun, it is essential as an auxiliary for boat work, either attacking boats, boarding, or covering landing parties, and as an auxiliary field-gun for naval service. It further is useful in tops of ships, and commanding positions in vessels, where, from its comparative lightness, it can be easily shifted about, to search out ports and conning towers, &c. For clearing streets, holding positions, and the many varied and sudden duties the Naval Service have to perform on shore, it is unequalled in utility. In these days when ships are built with rams, and Captains may be tempted to use them, what a fearful weapon the rifle-calibre machine-gun would be to play upon the boarders, who as a necessity would be ready to board or repel boarding. It may be here remarked that it is not the number of shots that can be fired without aiming by a machine rifle-calibre gun that makes it so valuable, but *its power of being able* to fire them on occasions when the sights are on, and also the tremendous reserve which they undoubtedly are.

The practical value of machine-guns throwing bullets under certain conditions has been very well tested at Alexandria lately, most decidedly in their favour. Captain Walford, R.A., in an excellent and able paper read in the theatre of this Institution on Friday, February 16th, 1883, relative "to the effects of the bombardment of the Forts of Alexandria,"¹ appears to be mistaken or wrongly informed on this matter. Captain Walford remarks on the few hits apparent, and the total absence of bullets found about the ports and batteries, but he visited the scene some considerable time after the engagement, when marks may or may not have become obliterated, but when there was certainly no chance of picking up a bullet, after the crowds of soldiers, seamen, and Arabs had searched everywhere to find relics of the fight. I may, however, state, that when first sent to Mex, I picked up myself six Nordenfelt bullets all lying close together, and not far from the rear of one of the 10-inch guns, and I frequently saw my men with others they had picked up. I may also add that two Egyptian Officers, who were prisoners under my charge when Chief of the Police at Alexandria, told me, through an interpreter, that the Egyptian gunners would have laid their guns much better if it had not been for the moral effect produced by the continual hail of bullets going over their heads. One

¹ Journal, vol. xxvii, No. CXIX.

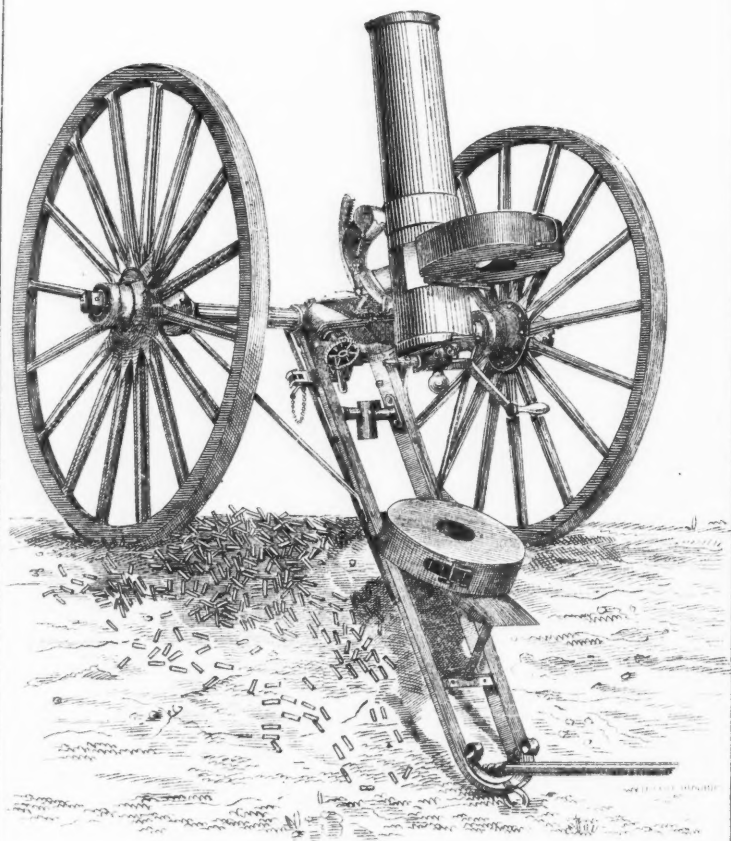
[illegible]

GATLING GUN.

MUSKET CALIBRE.

Showing New Style of Feeding

Scale $\frac{1}{16}$.



of these Officers was on duty the whole time of the action in the Ras-el-tin Battery. The Gatlings were generally out of range during the action, so the only conclusion can be that the bullets mentioned were Nordenfelts. The Gatlings, however, came in very usefully for the landing, clearing the town of riot, and restoring order. It was openly stated by Arabi's Officers and men that nothing would induce them to face machines that "pumped lead," which referred to the Gatling, with which Captain Fisher held the lines with 370 men during four anxious days and nights. Such was the terror inspired by these guns when used for clearing the streets, that although there was an army of over 9,000 men within a short distance, they would not face the small party of 370 men, who held the lines with the Gatling guns.

Having now explained as well as I am able the use, advantages, and classes of machine-guns requisite for the Navy, the question will certainly be asked, why are three different classes wanted, as surely one would do? The conclusive answer to this must be, that the naval services are so varied, their system of attack and defence so different on different occasions, that it is impossible to have a single pattern gun and rifle, as it is to have a single pattern ship or boat. For brevity's sake the three classes of machine-gun may be called—

- | | |
|-----------------------------|-------------|
| A. The rifle-calibre gun— | Calibre .45 |
| B. The torpedo defence gun— | „ 1" |
| C. The shell and 2-pr. gun— | „ 1.5" |

Each of these guns should have their place in every man-of-war. We have got the A and B class in very small numbers, which may determine great things, particularly *in defence*, but we have not a single one of the C class or shell-gun, which would be invaluable *in attack*, and which I firmly believe would seal the fate of an action between two otherwise equally armed ships. To explain more fully my meaning, I have tabled three ships of the French, and three of the English fleets as they were at Alexandria. Taking "La Galissionière" and "Invincible," the "Galissionière" has, besides the advantage (which ought to enable her easily to win) of having all her heavy guns breech-loading guns, and two heavy guns with an all-round fire, the enormous *extra* advantage of twelve 1-pr. Hotchkiss shell-guns (as she is at once to be given six more than she had at Alexandria). With these it is almost a certainty that she ought to win an action against the "Invincible," if they were engaged, although the "Invincible" is a larger, more costly, and heavier vessel in all respects than the "Galissionière."

France.

"La Galissionière". . Barbette. 2 24-cm. guns B.L.R. (better gun than English 12-ton gun).

Upper Deck. 6 14-cm. guns B.L.R., ditto.

Main Deck. 4 24-cm. gun B.L.R.

6 Hotchkiss¹ (to have 6 more immediately).

¹ Placed there before one Nordenfelt gun in the English fleet.

- "Alma" Barbette. 2 19-cm. guns B.L.R. (equal to our 6½-ton guns). Weight, 7¾ tons.
 Upper Deck. 4 14-cm. guns B.L.R.
 Main Deck. 4 20-cm. guns B.L.R.
 4 Hotchkiss¹ (to have 6 more).
- "Thétis"..... Barbette. 2 19-cm. guns.
 Upper Deck. 4 brass converted, about 16-pr. M.L.R. guns.
 Main Deck. 4 20-cm. guns.
 4 Hotchkiss¹ (to have 6 more).

English.

- "Monarch" In turrets. 4 25-ton M.L.R. guns.
 Under F.C. 2 12-ton M.L.R. guns.
 Main Deck. Stern fire. 1 6½-ton M.L.R. gun.
 7 Nordenfelts, and 1 Gatling.
- "Invincible" Upper Deck. 4 12-ton M.L.R. guns.
 4 6-in. M.L.R. guns, 64-prs.
 Main Deck. 6 12-ton M.L.R. guns.
 4 20-pr. Nordenfelts; 1 Gatling.
- "Alexandra"..... Upper Deck. 2 25-ton M.L.R.
 2 18-ton M.L.R.
 Main Deck. 8 18-ton M.L.R.
 6 20-pr. B.L.R. Armstrong.
 8 Nordenfelts.

This undoubted superiority, ship for ship, which the French Navy possesses at this moment means, that in a sudden war between England and France there is a chance of our being beaten. Why should there be such a chance (there ought to be none); and what does being beaten on the sea mean for England? It means certain, unavoidable, but disgraceful capitulation. It is of no use calling attention to the fact that all our riches, all our power, and nearly all our food are actually dependent upon the strength of our Fleet, and its readiness for immediate action. Every child knows that such is the case. If we are beaten at sea, we might have to pay four times as much as the French paid after 1871, this means about 800,000,000². If we are beaten at sea we have no other resource to turn to, and the victor can fix his terms to us or starve us. It is no question of years as it used to be, it is one of weeks, and as time rolls on, the capitulation would be made in days if we were beaten.

But the question will be asked—are all these horrors going to occur because England has not got a few hundreds of machine shell-guns? My answer is, that the machine shell-gun question is one of several all-important ones that want seeing to and settling immediately, if we, as seamen, are to be in the position the country gives us credit for—that of holding the undoubted supremacy of the sea. The shell-gun question is, however, the *only* one that can be settled

¹ Placed there before one Nordenfelt gun in the English fleet.

² Or the approximate amount of one year's imports and exports.

AT ONCE; and, therefore, I have brought it forward illustrated by the actual facts contained in my statement. Time after time, in both Houses of Parliament, comparisons between our Fleet and other Fleets are deplored; but why? Are these regrets common sense? How are the Armies upon which Continental countries rely for their existence regulated as to strength and readiness, but by comparison with each other, and if we wish to exist, we must compare our Fleets with those of other nations, and when we look carefully through these comparisons, there should not be discernible the very remotest chance of our being beaten at sea. The result of this comparison should be far different from what it is now, where even one nation has a chance against us, but where a combination of two or three would have a certainty of beating us.¹

Our *personnel* in the Navy is as good or better than ever it has been. I do not wish it to be understood that I think the Officers or men have deteriorated, but we should have to meet an enemy with a better weapon than we possess. I wish to have an equal chance with whomsoever we meet.

Another question will also be asked, and this probably by many,—if these things are as is stated, whose fault is it? That is soon answered; it is England's own fault, it is the country's fault, it is not a party question, as one party is just as bad as another. Don't suppose that all the facts glanced at in this paper are not thoroughly well known to every naval man and to all the Officers at the Admiralty, but what can they do? The people in authority who know these facts are obliged, as a sort of matter of honour, to concur in what I may call the "Treasury policy for the hour," and that policy is always the same whatever party is in office. It is one of *misjudged economy* for the Services. The country always approves of this and won't allow money to be spent, and, therefore, what is to be done? But if the time comes, which is by no means impossible, when we may be beaten at sea, don't upbraid and reproach the Navy or its representative authorities. We are not nearly in the position to do all that will be *confidently* expected of us in a sudden war with a European Power, and what war can be other than sudden now. Many grave and unlooked-for events must occur in these days of invention, on the sea, which will tax the energy and resources of the Navy to the utmost. We must be given the best ships, the best guns, and the best attention that money and foresight can buy or command to feel confident as to our ability to fulfil the many and sudden obligations which would certainly be thrown upon us in time of war.

Have we got, either in quality or quantity, what we should have, to fulfil these conditions? No! because it is a question of money. The money voted for the Naval Service is simply the insurance England pays for her wealth and prosperity. Taking year after year, is the increase in this insurance, as represented by the Naval Estimates, anything at all in proportion to the feverish increase of naval armaments abroad, or to the gigantic increase of our wealth and prosperity as represented by the tonnage of our Mercantile Marine and the value

¹ Give us an equal chance, and pluck will carry us through.

of exports and imports? for this increase of our Mercantile Marine adds more and more to the vital spots open to easy attack by an enemy, as the whole of it would be under the protection of the Navy in time of war. The annexed table clearly answers this question.

Navy Estimates.

1854-55.....	£7,487,948
1880-81.....	10,492,935

Value of Imports into and Exports from the United Kingdom in each of the Years 1854, 1860, 1870, and 1880, so far as the same can be given.

Years.	Imports.	Exports.		Total value of imports and exports.
		Of British produce.	Of Foreign and Colonial produce.	
	£	£	£	£
1854.....	152,389,053	97,184,726	18,636,366	268,210,145
1860.....	210,530,873	135,891,227	28,630,124	375,052,224
1870.....	303,257,493	199,586,822	44,493,755	547,338,070
1880.....	411,229,565	223,060,446	63,354,020	697,644,031

Total Tonnage of British and Foreign Vessels that Entered and Cleared in the Foreign Trade at Ports in the United Kingdom in each of the Years 1830, 1840, 1850, 1860, 1870, and 1880.

Years.	Entered.			Cleared.		
	British.	Foreign.	Total.	British.	Foreign.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1830	2,180,042	758,828	2,938,870	2,102,147	758,368	2,860,515
1840	3,197,501	1,460,294	4,657,795	3,292,984	1,488,888	4,781,872
1850	4,700,199	2,400,277	7,100,476	4,742,345	2,662,243	7,404,588
1860	6,889,009	5,283,776	12,172,785	7,025,914	5,490,593	12,516,507
1870	12,380,390	5,732,974	18,113,364	12,691,790	5,835,028	18,526,818
1880	20,490,512	8,583,043	29,073,555	20,858,472	8,804,036	29,662,508

The present Naval Estimates give us a Navy which is barely able to defend itself. What is to become of the 21,000,000 tons of British shipping which conveys our food and wealth, and is the mainstay of our prosperity, if a sudden war breaks out and the Fleet is worsted in even one action? The popular belief is that the mercantile steamers could take care of themselves, but that is only a supposition. The only possible manner in which they could take care of themselves would be in their ability to steam very fast in an opposite direction if they met

an enemy's cruiser. The guns proposed to arm these steamers with are obsolete and useless when compared with the armament that any foreign cruiser would possess. England possesses no stores of modern war *matériel*, and therefore at present cannot possibly place any armament in her great mercantile fleet, of either an offensive or defensive character, which could ensure in any way the safety of themselves or of the valuable cargoes they carry.

Annexed are tables showing the various machine-guns and their trials, weights, penetration, velocity, and description of projectiles; also a table showing the various machine-guns on trial by England and other nations; these tables are interesting and instructive, and show some very clear comparisons.

In the above remarks I hope it may not be thought that it is intended to throw blame upon the authorities and my superior Officers. I have simply stated actual facts with a view of strengthening the authorities' hands to ask for more money to put things right in the Navy.

Machine-Guns.

Navies of	In use and under delivery.	Under trial.
England	566 1-inch Nordenfelts. 3 Hotchkiss. No shell-gun of any kind.	2-pr. Nordenfelt shell-gun. 6-pr. shell-guns proposed by Armstrong & Co. Ditto Hotchkiss. Ditto Nordenfelt.
France.....	752 Navy } 303 War De- } Hotchkiss part. } shell-guns. No Nordenfelts.	3-pr. shell-guns proposed by Hotchkiss. Ditto Nordenfelt.
Germany	303 Hotchkiss shell-guns. No Nordenfelts.	Krupp's factory ordered to construct suitable heavier shell-gun.
Italy	42 1-pr. Hotchkiss shell- guns. 100 1-inch Nordenfelts.	2½-pr. Nordenfelt shell- gun.
Russia.....	106 1-pr. Hotchkiss shell- guns. 37 1-inch Nordenfelts (Palmerantz).	2-pr. Nordenfelt shell- gun. 2½-pr. Hotchkiss shell- gun. 1-inch Nordenfelt.
Austria	42 1-inch Nordenfelts. 16 2½-pr. Hotchkiss shell- guns.	2-pr. and 3-pr. Nordenfelt shell-guns.
Sweden.....	30 1-inch Nordenfelts. No Hotchkiss.	2-pr. Nordenfelt shell- gun. 2½-pr. Engstrom breech- loader.

Navies of	In use and under delivery.	Under trial.
Norway.....	6 1-pr. Hotchkiss shell-guns. 2 1-inch Nordenfelts.	
Denmark.....	67 1-pr. Hotchkiss shell-guns.	2½-pr. Hotchkiss. 2½-pr. Nordenfelt shell-guns.
Holland.....	121 Hotchkiss. No Nordenfelts.	
Spain.....	24 1-inch Nordenfelts. 1 Hotchkiss.	
Greece.....	42 1-pr. Hotchkiss. ? 1-inch Nordenfelt. ? 2-pr. Nordenfelt shell-guns.	
Turkey.....	150 1-inch Nordenfelts. 5 Hotchkiss.	2-pr. Nordenfelt shell-gun.
United States of America..	43 Hotchkiss. No Nordenfelts.	
Brazil.....	66 1-inch Nordenfelts. 6 2-pr. Nordenfelt shell-guns. 11 Hotchkiss.	
Argentine Republic.....	4 1-inch Nordenfelts. 11 Hotchkiss.	
China.....	24 1-inch Nordenfelts. 26 1-pr. Hotchkiss.	
Japan.....	14 1-inch Nordenfelts. 1 Hotchkiss.	
Chili.....	38 Hotchkiss.	
Portugal.....	3 Hotchkiss.	
Other small States.....	21 Hotchkiss.	

Rifle-Calibre Machine-Guns.

Gallings,... 300 delivered to England, 500 to Russia, 600 to Turkey, and smaller numbers to other countries.

Gardiners,... 350 ordered by England, none by any other country.

Nordenfelts,... 84 delivered to Sweden, 50 to Turkey, 40 to the Argentine Republic, 23 to Brazil, and smaller numbers to Roumania, Egypt, Spain, Portugal, Peru, Norway, the Cape, &c.

Memorandum of Particulars of new Gatling Gun and 6-pr. Rapid Fire Gun.

Gatling Gun.

Gun.....	230 lbs.
Gun-carriage.....	260 "
Gun-carriage ammunition boxes for 4 magazines with bullet-proof faces.....	65 "
Limber to hold 12 magazines and 10,000 rounds of ammunition.....	450 "
16 magazines (14 lbs. each).....	224 "
10,000 rounds of ammunition (120 lbs. per 1,000).....	1,200 "

6-pr. Gun. Armstrong.

Weight of gun.....	4 cwt.
" projectile.....	6 lbs.
" charge.....	2 "
Velocity of projectile.....	1,650 feet per second.
Calibre.....	2.25 inches.
Length of bore.....	67.5=30 calibres.
Bursting charge of common shell.....	12½ ozs.
" " shrapnel.....	½ oz.
Number of bullets in ditto.....	92

Comparative Weights.

A. Field Carriages.

Description.	9-pr. field gun.	13-pr. field gun.	Nordenfelt 5-barrel machine-gun mounted on its galloping carriage.	Service new 12-pr. B.L. Field Artillery mounting.
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Gun-carriage with gun mounted ...	19 0 12	20 0 0	8 3 4 including 12 hoppers	38 0 0
Limber packed....	16 0 4 including 36 rounds	17 3 0 including 36 rounds	8 3 20 including 5,090 rounds	With 2 gunners and kits on limber
Total weight.....	35 0 16	37 3 0	17 2 24	38 0 0

B. Naval Landing Carriages.

Description.	9-pr. M.L. gun.	12-pr. B.L. gun.	Gatling 0.45-inch gun.	Nordenfelt 5-barrel machine-gun.
	cwt. qrs. lbs. 8 0 0	cwt. qrs. lbs. 8 0 0	cwt. qrs. lbs. 3 3 24	cwt. qrs. lbs. 1 0 16
Gun.....				
Gun-carriage and limber, packed....	16 0 25 including 24 rounds	19 1 25 including 24 rounds	13 1 9 including 1,500 rounds and drums	10 0 4 including 5,000 rounds and hoppers
Total.....	24 0 25	27 1 25	17 1 5	11 0 20
Number of crew....	18 men	18 men	14 men	8 men

Hotchkiss Machine Shell-Guns.

Navies of	In use and under delivery.
England	3
France	752 Navy 303 War Department
Germany.....	303
Italy	42
Russia.....	106
Austria	16
Norway.....	6
Denmark.....	67
Holland.....	121
Spain.....	1
Greece.....	42
Turkey	5
United States of America	43
Brazil	11
Argentine Republic.....	11
China.....	26
Japan	1
Chili	38
Portugal.....	3
Other small States	21
Total.....	1,921 on May 1, 1883.

The Nordenfelt, Gardiner, and other Rifle-Calibre Guns.

Gun.	Weight of gun.	Number of barrels.	Nature of fire.	Rapidity of fire.						Total number of pieces in the guns.	
				Time of firing 1,000 rounds.	Firing 3,000 rounds.		No. of rounds fired in 1 minute.	No. of rounds in 30 seconds.	No. of rounds per 10 lbs. of weight of gun.	Per barrel.	Total.
					Time of firing.	No. of reliefs of men.					
French Mitrailleuse	lbs. 690	25	Volley	" "	....	....	180	100	1.4	....	....
Gatling (Service)	444	10	Single shots	....	....	....	400	220	4.9	....	....
Gardner.....	280	5	Volley	1 35	6 20	Nine	650	336	11.7	23.4	117
Do.	101	2	Single shot	2 57	11 39	Five	400	236	23.3	33.0	66
Do.	56	1	"	5 40	....	....	200	120	21.4	....	....
Nordenfellt	230	10	Volley	0 59	3 3	None	1,017	510	22.1	10.8	108
Do.	120	5	"	1 41	5 47	None	600	360	30.0	16.0	80
Do.	56	3	"	2 40	10 30	None	400	220	39.2	11.7	35
Do.	36	2	"	3 9	....	....	320	180	50.0	14.5	29
Do.	13	1	Single shot	5 57	....	....	180	100	76.9	23.0	23

The Nordenfolt Valley-Firing Gun and the Hotchkiss Revolving Cannon firing Single Shells for Defence against Torpedo Boats.

Gun.	Calibre.	No. of barrels.	Total weight of gun and mounting.	Weight.		Velocity.		Energy per sq. inch of sectional area of projectile.		Rapidity of fire.						Penetration.		Portsmouth trials, 1880.									
				Powder charge.		Projectile.		Muzzle.		At 1,000 yds. range.		10 secs.		30 secs.		1 min.		300 yards.	1 inch iron.	No. of shots fired.	No. of hits made.	Time.	No. of shots fired per minute.	No. of hits made per minute.	No. of rounds per hit.		
				Maximum.	Aiming.	Maximum.	Aiming.	Maximum.	Aiming.	Maximum.	Aiming.	Maximum.	Aiming.														
Nordenfolt	1	4	cwt. qrs. lbs. oz. #7 0 19	1.53	7½ oz.	f. s. 1,500	f. s. 806	ft.tns. 9.1	ft.tns. 2.6	40	20	100	60	200	120			932	359	22	20	41	7	16	07	2	59
Hotchkiss.	1.46	5	#5 0 2 2.9		18	1,400	834	9.4	3.3	10	3	30	8	60	14	Steel shot 1½" iron. Com. shell 2" steel.		334	136	23	14	14	3	5	85	2	4

* See Page 349, "Manual of Gunnery, 1880."

The Nordenfelt and Hotchkiss Shell-Guns.

Gun.	Calibre.	Weight of gun.			No. of barrels.	Weight.		Chilled shell.		Common shell.		Velocity.		Energy per sq. inch of sectional area of projectile.		Rapidity of fire.		Penetration.		Energy at muzzle.			
		cwt.	qrs.	lbs.		oz.	lbs.	grs.	lbs.	oz.	f. s.	f. s.	ft. tns.	ft. tns.	At 1,000 yards range.	Muzzle.	At 1,000 yards range.	Maximum for one minute.	Aiming for 1 minute.	Distance.	Target.	Total.	Per 1 cwt. of weight of gun.
Nordenflett	1·5	2	2	0	1	8·5	1·75	1·75	85	1·75	1·4	1,750	1,043	21·0	7·5	ft. tns.	ft. tns.	29	15	300	2½"	21	8·4
Hotchkiss.	1·85	11	3	7	5	7·05	2·5	2·5	667	2·5	1·5	1,394	902	12·04	5·0	ft. tns.	ft. tns.	40	19	300	1½"	12·04	1·2
"	2·09	21	2	17	5	12·7	4·0	4·0	1,122	4·0	2·6	1,345	954	14·5	7·3	ft. tns.	ft. tns.	40	10	300	1½"	14·5	0·7

THE CHAIRMAN : The object of reading papers in this Institution is that they should be fully discussed. We shall now be happy to hear any observation that any person may wish to offer.

Vice-Admiral VESEY HAMILTON, C.B. : I wish to make a few remarks on the very instructive lecture to which we have just listened, and before doing so to thank the lecturer for giving us so much valuable information. The strong point that he has laid before us is the inferiority of our ships in point of armament to those of the French, and upon that point I think the gallant lecturer is a better authority than any one here, for very recently he has been employed in co-operation with the French Navy, and therefore he knows their qualities better than we do. On that point I accept his statements unreservedly, though I am very sorry to have to do so, but those who know Lord Charles Beresford know very well that he is not one of those who foul their own nest. Very lately we had a discussion in the House of Commons upon the Navy Estimates, which was opened by a noble lord, proving incontestably from statistics that the state of the Navy was very black indeed. He was followed by another member of the House, who by equally incontestable statistics proved that the Navy was all white. He was again followed by blacks, and so it went on alternately, blacks and whites. What the real truth is nobody knows, and the House of Commons, or those few who listened,¹ are perfectly satisfied that we should remain in that state. I am afraid statistics are something like the old saying of the foes of lawyers' agreements, that they lie first on one side and then on the other, and when they are dead they lie still, because anything can be proved or disproved by them. There was one very sensible suggestion made, and that was by the First Lord of the Admiralty, when he said it was necessary to have a Royal Commission to investigate the relations between the Admiralty and the Ordnance Department of the War Office. No doubt an increase of machine-guns is an actual necessity. The lecturer has pointed out the demoralizing effect of a rain of lead bullets. Now I cannot give a better illustration of the moral effect of having a good weapon in your hands than that afforded by the late disturbances in Ireland. In April, 1880, the first thing between Dublin and Queenstown that struck me was at every railway station a constable with his sword bayonet and rifle handy; and in all the riots that have occurred lately in that country, all the constables were armed with rifle, bayonet, and ammunition (of which we have all heard a good deal), buckshot. Now an Irish mob is not at all a pleasant mob to deal with when they think that you will put up with their gentle amenities; and there is nothing of which the British nation ought to be more proud than of the admirable manner in which the Irish Constabulary and the troops stood the showers of stones, mud, &c., and abuse, that they received,—as no other nation's armed force would have done. But when the Irish mob found that the troops were in earnest, and meant to use those weapons, there was no more of that sort of work. There is no doubt about it that the admirable manner with which those troops and police stood those attacks was owing to the knowledge that, when it came to the point, the weapons they possessed gave them an overwhelming superiority over the brute force of the Irish mob. I should like to know where the A, B, C, or D divisions of the English police would have been if they had been mixed up with an Irish mob, armed only with their batons. I am afraid but few would have been left. The gallant lecturer called attention to the manner in which the French were supplied with machine-guns long before we were. That, I think, is a most humiliating fact, that the English Navy, one of the largest in the world, should have to follow in the wake of a country whose secondary consideration will always be its Navy, and its first consideration its Army. The lecturer has pointed out that the Nordenfält 1-inch gun is the best gun we possess against the attack of torpedo-boats. I am delighted to hear that, for the simple reason that the gun was introduced into the Service purely by the Navy against the strong opposition of the War Office, so strong that Mr. Ward Hunt at last took upon himself to order 100 Nordenfält and the corresponding

¹ I have twice attended debates on Navy Estimates. During those eight hours there were at no time forty members present, and at one time only six.—V. H.

ammunition, a very extensive order it was, and a very great responsibility he took upon himself, about a quarter of a million, and we know the admirable results that have followed from that bold step, and we must all regret that he is not here to-day at this lecture. There is one curious fact I should have liked to have remarked with regard to the names we have heard to-day, Nordenfelt, Hotchkiss, Gatling, and Gardiner, they are all foreigners. We naval men are deeply indebted to them for having given us weapons that enable us to repel the attacks of torpedoes. In fact, before that, we in the ironclads were very much in the position of the lion in the menagerie who in his old age was so worried and teased by rats that they did not know what to do for him. At last a little terrier was put into his cage. At first, the lion did not approve of this addition, but when he saw the little terrier kill the first rat, he took to him at once. Now Mr. Nordenfelt has given us the terrier to enable us to beat off the rats that will attack our ironclads. But I should be much better pleased if these men that we have heard of to-day were Englishmen, for I think there are Vavaseur and Whitworth, Armstrong, and a host of other English civil engineers who would have supplied us excellently well. There is one subject on which English politicians are particularly strong, and that is the subject of free trade, but the closest monopoly in the kingdom is the manufacture of guns. The British man-of-war is built entirely of contract materials except the very article which she is built to carry. A vessel costing half-a-million ought to carry the best guns that can be put into her. I am perfectly certain that if we were to throw open the competition in guns to all our eminent civil engineers they would do as our eminent engine-makers have done with regard to engines, give us the best in the world, and the Admiralty should have the power of purchasing the best weapon. The lecturer states that by the 31st March, 1884, the Navy will possess 565 Nordenfelt machine-guns of 1-inch calibre, throwing a solid steel bullet, and principally useful in repelling torpedo-boat attacks; added to this, on the same date the Navy will possess, or should possess if the contract is fulfilled, 350 Gardiner machine-guns, .45, or rifle, calibre, throwing lead bullets. Now I would suggest that he should add to that, that "the Navy will possess, or ought to possess," so many Nordenfelts, unless he goes upon some certain data of official utterances; official utterances in the days of "Sir Joseph Porter, K.C.B." were infallible, but I do not think naval men will say they are so now. The paper I have here is a Return laid before the House of Commons of the number of guns ordered for the Navy during the last three years and the number supplied. In the first year, that is 1880, there were thirty-two guns ordered: the number made was more; 11,000*l.* was taken in the Estimates for that; what has become of that I do not know. The next year 125 guns were ordered at the estimated cost of 74,000*l.*, 44 of those guns were made, but none delivered to the Navy.

The CHAIRMAN: Were they machine-guns?

Admiral HAMILTON: Guns of all sizes. Altogether in those three years 389 were ordered, and only 77 have been supplied to the Navy. I hope the gallant lecturer is going upon some certain data as to the number that we shall have. We ought to possess that number, but we ought to possess three times that number.

Captain P. H. COLOMB, R.N.: My only reason for speaking at all on this subject is that I happen to have had something of an official connection with it, having presided over the Machine-Gun Committee, which ultimately brought the Gardiner gun into the Service for some months. The lecturer has described some of the advantage of shell machine-gun fire, in most of which I thoroughly agree. There is, however, one point which, I think, he puts rather too strongly, and that is the advantage which shells would give us in finding the range. The shell would not give us the range unless it actually struck the ship, for I presume in all cases of machine-gun fire time-fuzes would not be used. I suppose that would be the case?

Lord CHARLES BERESFORD: A 2-lb. shell will burst on striking the water.

Captain P. H. COLOMB: I am very glad to have brought out that explanation, because it seemed to me to want it. Then, I think, we must keep in mind, in this question of range, that in the attack and defence of fleets the range is constantly altering, that we cannot expect to get many discharges from any machine-gun on board ship without re-laying between every round. I am not quite in

agreement with the lecturer on the subject of protecting the machine-guns. I do not think that protection necessarily limits the arc of training. I think protection can be devised which will leave the arc of training free or very nearly free, and I think that the advantage of protection in the face of machine-gun fire is so great that even some training might be given up, with advantage, to it. I am very strongly on the side of the lecturer when he says that the man who lays the gun should also fire it. Having fired a good many rounds myself I have felt that necessity strongly, and it has always struck me that if inventors would turn their attention to making use of the firer's foot as well as of his hand something in that way might be done. No arrangement of treadle has as yet been proposed that I know of, but it seems to me we may get the laying very conveniently arranged, and the firing done by the foot, which would be a movement entirely under the control of the person operating. I do not quite agree with the definition of machine-guns given by the lecturer. I think that any gun which gives you exceedingly quick firing should be called a machine-gun. The quick firing 6-pr., which we are to have, may be mounted on a central pivot in the same way as Mr. Vavasseur now mounts his gun, and will, I think, to all intents and purposes be a machine-gun; but there is this to be said, that the real advantage of the machine-gun consists more in the ammunition than in the gun itself, and if you fix upon the kind of ammunition you want to fire, you should be prepared to fire it from a great variety of machine-guns; that you may have one barrel, two, three, or ten, or twelve barrels, according to the nature of the work you propose to do, and that you need not restrict yourself to any particular pattern, so long as each pattern fires the same ammunition. In the Gardiner gun it is a defect that we still have to use a special ammunition, and although I thought we should be able to use the ordinary rifle ammunition, yet until the rifle ammunition is altered and made solid-drawn, the Gardiner gun must have ammunition of its own, which I consider a drawback. Of course I must corroborate, as every naval Officer cannot help doing, the latter part of the lecturer's statement.

Vice-Admiral BOYS: I rise from the same reason that my predecessor has risen, because it was my duty to succeed him in his position as Chairman of the Machine-Gun Committee. We must all feel obliged to our gallant lecturer for the subject he has brought before us, and the way he has treated it. He has continued his argument throughout very clearly. His main object is evidently to obtain for the Naval Service a shell-firing machine-gun. He has dealt with other machine-guns also, but in some of his details he must allow me to differ with him. I know what the Council of the Institution wish is, viz., to have discussions on the papers read, and I am sure the lecturer himself will not object to any fair criticism on what he has said. He says, "A machine-gun proper should have no recoil, and should also be heavy enough to resist any great vibration after being fired, so that the sighting cannot be affected by the discharge of the piece." That is undoubtedly what is required of a machine-gun, but practically it is an impossibility, as far as my experience goes. I have seen a great many machine-guns fired, and I always observed that the heavier they were the greater comparatively the shock of the discharge. Whenever a machine-gun is fired there is a vibration, if you fix the carriage ever so firmly,—a vibration sufficient to throw the projectiles off the spot which they are intended to hit after the first round, so that the gun requires constant re-laying. The lecturer has corrected a statement which is made here, that the English had no machine-guns at all until 1878. There were two descriptions in the Navy before that date, the 1-inch and the 45-inch Gatlings. Now I must follow Captain Colomb in his statement about the practicability of finding the exact range from the effect of shells bursting, and I put it in two ways; the first is, as I think was pointed out, there are no time-fuzes, so that shells only burst on impact, and a shell will burst on striking the water. I have seen several of these Hotchkiss shells fired; you do see them strike the water and you see the splash, but you do not see the bursting of the shell, and a few seconds afterwards amidst the spray you may see a little puff of smoke floating away, but that does not give you a definite point for getting the range. Then supposing this shell passes through an unarmoured ship, the effect of the impact of the projectile causing the bursting of the shell occurs inside the ship, and the consequence is you do not see the burst at all; you see no more than if it

had been a solid bullet striking the ship. I do not think it can have any effect in discovering your range where two objects are moving rapidly, like torpedo-boats or ships passing each other. In fact the succession of firing is so rapid that it is most difficult to fix a continually altering range. This is not the time to discuss the question of muzzle- and breech-loading, but there is a fact connected with machine-guns, which is this, that with our muzzle-loading gun the gun recoils inside the port; the port is lowered, and you merely have a small aperture through the port for the rammer-head to go through. But with breech-loading guns they are always out, the ports are always open, and the consequence is the crew of a breech-loader are actually more exposed to the fire of machine-guns than the crews of muzzle-loaders. I am quite aware that the time of muzzle-loading guns is passed. In the future we may revert to them if our chemists will invent for us a description of powder that does not require a long cylinder in which to burn it in order to obtain high velocity, and thus avoid the complications incidental to breech-loading arrangements not required for short guns. There is another point in which Captain Colomb appears to agree with the lecturer, that is when he says, "It is imperative that the man who sights the gun should be able to fire it, as the eye and hand must work together." I differ from that, and I maintain that it is not an absolute necessity that the man who fires a machine-gun should lay it. I invite any one here to sit down behind the Nordenfelt gun and try it with one hand on the elevating wheel, the other on the directing wheel, and the eye on the sights; if he is well in accord with the man who works the firing lever, I say you will get better shooting by having two persons, one to point and the other to fire that gun, than by having only one to do both, and for this reason: that the man who points the gun has both his hands engaged. He has his eye steadily along the sights. The act of firing the gun is somewhat laborious; if you continue firing the Nordenfelt gun for a minute or two, you will find there is a considerable effort required, and every time you fire the gun you take your eye off the sights. The lecturer has made an apparently apt illustration as to grouse-shooting, and I quite agree that the grouse would have a cheery time of it if there were two men to attack them as described, but supposing if when you alone were shooting grouse, you had to take your hand off the trigger to stretch your arm out, to take your eyes off your sight, and bring them back every time you fired, then I think that the result would be different, and it would be more like the case of pointing and firing a machine-gun. There is another consideration with regard to machine-guns which must not be lost sight of, and that is the uncommon waste of ammunition involved and the necessity for carrying a larger quantity of ammunition for all descriptions of machine-guns, because the reserve supply of ammunition is a most important one. Now I would ask the lecturer why he happens to have selected these three ships, the "Galissionière," the "Alma," and the "Thétis"—I think the "Alma" and the "Thétis" are two very old ships, looked upon by some persons as obsolete—in making comparisons between the French and English fleets?

Lord CHARLES BERESFORD: It is because they were at Alexandria.

Admiral BOYS: The lecturer says here that it is almost a certainty that the "Galissionière" ought to win an action against the "Invincible," if they were engaged, although the "Invincible" is a larger, more costly, and heavier vessel in all respects. I must say I do not agree with him, and I think every one here would think that if the lecturer himself commanded the "Invincible," the "Galissionière" would have a very small chance indeed, in spite of a few additional machine-guns. I think we might throw the "Alma" into the bargain, and that he would give a good account of both of them. I quite agree in the necessity for more machine-guns. The Estimates are the bane of the efficiency of the Navy, and I am sure if we only had a few more gallant Officers like our lecturer, who have the knowledge of technical subjects like this before us, are able to put it together, and are bold enough to bring it forward at this Institution, the Council, the authorities, and all who heard them would derive much useful information and could benefit therefrom.¹

¹ The Chairman had to remind me that the time for discussion was drawing to a close, otherwise I should have remarked on the different methods of loading and

Brigadier-General REILLY, R.A. : I wish to say a few words, though perhaps not quite allied to the subject of the lecture. An Admiral of the Navy has made some very unjust and very unfounded attacks upon the War Office with regard to the supply of guns to the Navy. I can say this—that the War Department can have no fear about a Royal Commission. We should be very glad to have it if it is thought worth while, and I think it will prove that in every way that can be, the Navy receives the greatest support in the manufacture of their guns and of their war *matériel*. Everything is done for them that is required. However, he says he does not believe people who are interested in maintaining the present state of things in the House of Commons, and therefore he will perhaps think I am interested as an official in keeping the present arrangement, and he will not give much credence to what I say; but if that be the case, I will refer him to those whom he will believe, and I will refer him to the present Lords of the Admiralty, who will tell him that all the insinuations that he has made are unfounded. I rose to contradict these statements because my friend Lord Henry Lennox advised me to do so.¹

The CHAIRMAN : Do let us try to keep away from anything that savours of personality. The criticism was made on a Department, and you are very properly defending it.

Lord H. LENNOX : I assure you that there is nobody in this assembly who had less idea of addressing any remarks than I had when I came here to-day, but being so pointedly alluded to by my gallant friend, I am bound in honour to give him the flattest contradiction, and to say that with him I should welcome the appointment of the Royal Commission which was threatened by my right honourable friend Mr. Smith, only premising that I myself had suggested that very course in a humble pamphlet, which I published seven months previously. Therefore I entirely concur with Mr. Smith and with my gallant friend, and I hope that Royal Commission will issue. As regards what my honourable and gallant friend says, there is nothing like a friend who stabs you in the back immediately behind you, and certainly without any knowledge on my part. As regards the "Conqueror" guns, my statement was based upon the authoritative statement in Parliament of the honourable and gallant gentleman the Secretary of the Admiralty.

Admiral HAMILTON : I beg to say, in explanation, I was criticizing the Department, and I beg to apologize to any honourable member here present to whom I may have personally given offence.

The CHAIRMAN : I do hope and trust that we shall remember that we are discussing machine-guns. I am afraid that owing to the quotation of my friend Admiral Vesey Hamilton we have rather gone away from the subject. It is only natural that those who are interested in these matters personally should make their explanation, and having done so, I hope we shall now return to the machine-guns.

General REILLY : I only want to say one word with regard to that Return that was produced just now by Admiral Hamilton about the guns given to the Navy lately. It is perfectly capable of explanation. I recognized by the figures that it was the Report laid before Parliament, and signed by myself, and I am perfectly certain that the Royal Commission which the Admiral suggests will prove to him that the work has been very satisfactorily done. He says he does not know where the 12,000*l.* balance went. I can tell him that it went for the benefit of the Navy. I just want to say another word about these guns that we have lately been putting on board the ships in the Navy. It was stated in the House of Commons that the

firing machine-guns, viz., the reciprocating action of the lever and the revolving action of the crank. The lecturer evidently prefers the lever, although I would not condemn either system possessing other advantages, for this cause : after considerable experience, I prefer the revolving movement ; it is steadier, less laborious, and equally applicable to continuous or volley-firing. I should also have noticed the positive evidence given by the Egyptian Officers who were in the batteries during the late action as to the moral effect of the fire of the machine-guns of the fleet on the gunners at the guns, which is far more conclusive than any opinions that may have been formed by our own Officers.—H. B.

¹ Lord H. Lennox objected to this. I should perhaps have said, "instigated me to do so," or "dared me to do so."

"Conqueror" could not go to sea because her guns were not ready, and the noble lord in his remarks said he should believe in the breech-loading guns if he saw them. At the time that the "Conqueror" could not go to sea because her guns were not ready, where do you think they were? They were lying on the wharf at Chatham for her, and a letter had actually been written from the War Office to the Admiralty to say that the third gun was ready; in fact, it was blocking up the wharf at Woolwich, and it was desired that it might be taken away.

Rear-Admiral Sir MICHAEL CULME-SEYMOUR, Bart., C.B.: I have only risen once before in this Institution, and when I got outside a friend said to me, "I suppose you do not want to be employed, because if you did you would not make such a fool of yourself." Now, I think my friend was quite wrong. As I understand it, the Admiralty support this Institution, and if this Institution is to be of any use to the Admiralty it can only be so by gentlemen expressing their opinions here. The lecturer has started rather a new line, by not being at all afraid to state facts, and I think the lecture is of value very much with regard to the subject of the lecture, that is to say, with regard to machine-guns, but still more as drawing attention to one of the many points in which the Navy is starved. It is all a question, as he says, of money, and not party at all; it is exactly the same whether a Conservative or a Liberal is in office—the Treasury will only give a certain amount of money—that is what it comes to, and it is a question how you will spend it. The Conservatives spend it more in keeping every ship perfectly efficient, and the Liberals try to spend more money in getting more ships. I only rise to remark how little attention the country pays to the wants of the Navy. When the Estimates are brought forward in the House, the House is emptied immediately, and I hope the gallant lecturer, who has very many friends, having brought forward the subject, will be the means of helping a little in getting more money for the Service.

Major ROGERS, S.O.P.: Lord Beresford has invited the opinions of military as well as naval Officers, and, although not an artillery Officer, I claim to have contributed as much or more to the literature of this subject than any man in or out of the kingdom. I wish, in passing, to ask a question with regard to the 2-pr. machine shell-gun, which the lecturer desires to be introduced into the Service—how is the loading process carried on? The definition of a machine-gun (as to which Captain Colomb seemed to express some doubt) is, I take it, that it is loaded automatically. In the lecture delivered by Captain Walford (to which allusion has been made) it was freely asserted that out of 16,233 rounds fired from the Nordenfelt and 7,100 from the Gatling, no trace of bullets, except five, could be found. Yet in the tables prepared by Captain Walford he shows that the ships of the in-shore squadron, consisting of the "Penelope," the "Invincible," and the "Monarch," were engaged with the forts at a distance of 1,500 yards only, which is certainly within the range of machine-guns. However, we may accept the evidence of the two Egyptian Officers as conclusive, that bullets from the machine-guns were flying over their heads. I should like Captain Walford to sit in a mantlet placed at 2,000 or even 2,500 yards from the firing point, and to note the descent of the bullets from the Gatlings almost perpendicularly, and with a penetrative force equal to 5 or 6 inches of timber. This high-angle fire (of which the Gatling before us is capable) will, I think, form a great feature in the future of machine-guns. By it you can, by using 27 degrees of elevation, drop bullets into entrenchments at the rate of 1,400 rounds a minute. At closer quarters the angle of elevation must be increased. At 200 yards, for instance, 84 degrees are requisite. Tables have been prepared from actual experiment to establish these facts. The lecturer takes exception to the principle of the revolving system, and, although an old upholder of the Gatling, I am free to confess that the gun before us is as superior to the naval Gatling as the Martini-Henry is to "Brown Bess." However, we do not in this theatre desire to enter into the relative merits of these guns, so much as to sift the general question to the bottom. The world is wide enough and bellicose enough to reward each inventor in turn. The object of these discussions is, in fact, to stimulate the energies of inventors, and no doubt machine-guns will be perfected in time, but the real question is, What are we going to do with them? Sir, I am at a loss to conceive why it is that, after a dozen years of discus-

sion, the status of machine-guns in warfare is still problematical. Many of the suggestions made by Sir E. Hamley in a discussion on Mr. Gardner's lecture on this subject might, I think, have been practically illustrated during the late Egyptian campaign. First comes his question as to what might be expected from machine-guns in warfare with a nation ill-supplied with artillery or incompetent to use it. Secondly, what would be their use in bush-warfare in searching out a concealed enemy, of whose locality we had some idea. Thirdly, for home defence, might not machine-guns be employed at certain points for the protection of the lines of communication, where they would be of special service? And fourthly, would they not be useful during an insurrection for street combats? In America, during some disgraceful riots, the Gatling acquired the name of the "street-sweeper." General Hamley dwelt also upon the general usefulness of machine-guns, with cavalry as opposed to cavalry, with infantry, and finally with artillery, for its protection. Lord Chelmsford, on the same occasion, gave his experience by saying that the Gatlings did good service with the Naval Brigade at the battle of Ginghilovo, and he added that machine-guns *had* a future before them, not as employed with artillery but with infantry. And, Sir, I hope the day is not far distant when every infantry regiment will be supplied with a machine-gun to intensify its fire-action on occasion. The prejudice against machine-guns seems to be passing away, and I feel confident that the able lecture to which we have just listened will tend to confirm opinions in their favour, and perhaps to convert the stiff-necked. When we hear of such phrases as "of inestimable value," "unequalled in utility," "of incalculable effect," applied to the action of these weapons by such men as I have mentioned; when we hear the most successful soldier of the age express his conviction that the General who in the next big war utilizes machine-guns to the best advantage will have an immense opportunity, we may rest satisfied that England will not be behind other nations in providing the most effective machine-guns both for our naval service and for our armies in the field.

MR. J. BEVERLEY FENBY: I wish to be allowed to speak upon one or two engineering questions. With regard to sighting a gun in any way for a shifting range. The difficulties are very great, whatever system of sighting you may adopt, because, if you are firing at 1,000 yards range, and the sights are 36 inches apart, a very small deflection— $\frac{1}{1000}$ th of an inch—would throw the bullet an inch out of range for every 100 yards of the distance; and we all know that aligning the sights to $\frac{1}{1000}$ th of an inch is a sufficiently fine job when you are firing at a fixed object with an ordinary rifle. With regard to the question of vibration. The vibration of these machine-guns would always make the fire to some extent scattering; for I have found that a rifleman who is a good shot will make a better diagram on a target from 600 to 1,000 yards than you can possibly make with a machine-rest. The reason is shown by an experiment which I tried. I put an ordinary Snider barrel into a vice, and just held it tight, so that you could not easily move it with your hand. If you tap the barrel with a small mallet you will find that it vibrates; but no tapping of the barrel will make a rifle vibrate when a man holds it in the knee position, much less when he is lying down in the back position; because you could not make a tuning-fork vibrate if you held it between cork or india-rubber. A man's hand and shoulder are elastic; and remarkable as it may seem to those who have not tried it, I know as a fact that a good rifleman, who would have a good chance at Wimbledon, would beat any machine-rest in the world for firing with an ordinary soldier's rifle. With regard to ammunition. The gallant lecturer spoke about a one-barrelled gun. Now I am afraid a one-barrelled gun would get hot so rapidly that, except for about one minute's work, it could not be used at all. My experience is so with the Snider and the Martini. And there is another question with regard to the number of barrels in a gun closely connected with the question of the ammunition that you use. If you use the Service ammunition—the 450 calibre used in the Martini—I quite agree with the speaker who said it would be impossible to use the Martini Service ammunition in machine-guns with success, unless the Government adopt the solid-drawn brass case; for while they make the coiled brass case and attached head, the mouth of the cartridge will be sure to ruck up against the edge of the barrel before you have fired many rounds, and then you come to a dead stop, perhaps at the most critical moment of an action; but even if you have

a solid-drawn brass case I do not think you will find that, especially with a single-barrelled gun, you could go on with rapid firing for long at a time, more particularly with a light gun. I am afraid you could not fire any considerable number of rounds without wiping the barrel out. The barrel would get very hot, and leading would ensue; and there would be little or no lubrication to lessen the evil. In the ammunition which is now prepared for the Hotchkiss and Nordenfelt guns the projectiles are coated with brass or copper to avoid the leading or wearing of the barrel.

LORD CHARLES BEESEFORD: Allow me to reply shortly to one or two remarks that have been made. Admiral Hamilton expressed a wish that Englishmen should come forward and make a machine-gun to compete with those guns that are manufactured by people who are not English. Well, they have tried at Elswick, and more or less satisfactorily, but they have not got so good a gun as that made by either Mr. Hotchkiss or by Mr. Nordenfelt. As to a 2-pr. having a recoil, a 2-pr. has no recoil, even when placed upon its field carriage. A 3-pr. or a 6-pr. can easily be made without recoil, but the weight must be added to considerably to get such a result, and weight is a most important matter on board ship. As to finding the range; the French consider their 1-pr. Hotchkiss more useful in that one particular than any other. As to the advantage of breech-loading heavy guns always being in the port when the guns are being loaded against the muzzle-loader which has to be run in to be loaded, and the port lowered; the breech-loader will certainly take and deflect most of the machine-gun bullets fired at the port, whereas with the muzzle-loader the bullets would probably either enter the port or break it up if it were lowered. The question of having one or two men to work a Nordenfelt is one very much open to argument. I only gave my opinion, and I invite others to do the same. As to the question of ammunition for machine-guns; the great point with these machine-guns is not their being able to expend an enormous amount of ammunition, but their capability of being able to pour a terrible fire, if only for a few seconds, upon any given object, when their sights are on. I have been asked why I compared "La Galissonière," the "Alma," and the "Thétis" with the English ships; I did that because these were the ships that were alongside the English ships in Egypt lately. What Admiral Boys said rather strengthened my argument. The "Alma," "Thétis," and "La Galissonière," certainly are very old types of ships; but I say that the French ships named were almost made equal to our ships, (which were better), at Alexandria, on account of the machine-gun shell-fire which the French had, and to which the English have nothing to reply with. With regard to Captain Walford's statistics as to the Nordenfelt's hits and bullets picked up, I think we shall all allow that he arrived too late to know exactly where the marks were and what really occurred, but certainly too late to pick up any bullets. As to the one-barrelled *shell-gun*, I prefer the one-barrelled gun as a *shell-gun* because it is so light compared to the revolving Hotchkiss *shell-gun* with several barrels, but I prefer a three or five *rifle-calibre* gun to a one-barrelled *rifle-calibre* gun. The *rifle-calibre* gun which I have asked Mr. Nordenfelt to mount for me on my galloping carriage is a five-barrelled gun, and the advantage of this over a single-barrelled *rifle-calibre* gun is that if four of the barrels are put out of action by any untoward event, you can still go on pumping lead out of the remaining one: whereas with the one-barrelled gun, or a gun which is fired and worked by rotary motion, if anything at all goes out of order, you are out of action and you must cease firing. What the last speaker mentioned about vibration is perfectly true, but it is exactly what is wanted in a machine-gun. Even a volley gives enough vibration to form a scattering action of the bullets, which for repelling a torpedo-boat attack is most valuable. With a shell there is only the single shot to rely on; a volley gun with its vibration is certainly preferable.

THE CHAIRMAN: I am sorry the meeting has rather diminished, but I am sure even those who have gone away, and certainly all here present, will unite in giving me directions to thank our lecturer most cordially for his lecture. It is not merely that he has taken great pains to bring before us a very important subject, and that he has evidently also taken great pains to procure these guns and diagrams, but he has also in his paper spoken out in a manly and straightforward manner. It is the great object of this Institution—I am sure I am speaking the sentiments

of my colleagues on the Council—that subjects of this nature should be brought forward in the manner they have been brought forward by the lecturer, and thoroughly and freely discussed without any allusion to personalities or politics. These are the objects we have in view in keeping this lecture theatre open (indifferent as its accommodation may be), that subjects of this great importance, either naval or military, should be thoroughly and freely discussed. I will now close the meeting by returning to Lord Charles Beresford our very cordial thanks for bringing before us in so able a manner such an important question.

NAMES OF MEMBERS who joined the Institution between the 25th June and
1st October, 1883.

LIFE MEMBERS.

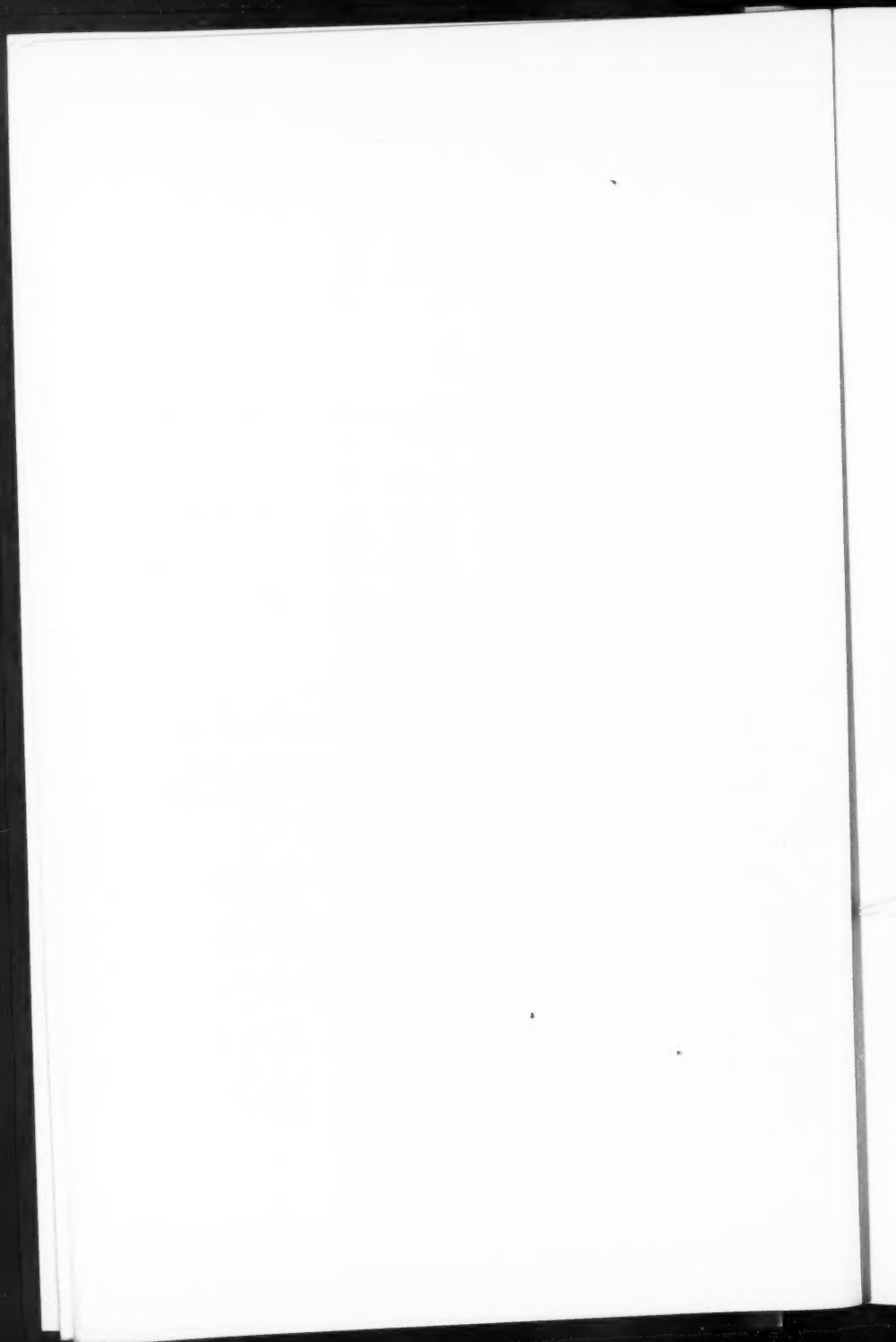
Elliot, E. H. M., Lieut. S. Lanc. Regt.	Johnston, W., Surg.-Major A.M.D.
Chevallier, B. H., Lieut. R.N.	Hornby, J. F., Major 12th Lancers.
Godman, A. F., Lt.-Col. 1st. Vol. Batt.	Calley, J. D., Lieut. 16th Lancers.
P. W. O. Yorks. Regt.	Dyson-Laurie, J. D., Col. the Border
Woolright, H. H., Lieut. Middx. Regt.	Regt.
Graham, R. W., Capt. Middx. Regt.	Headlam, J. E. W., Lieut. R.A.
Mann, G. F., Capt. R.E.	Smith, E. P., Lieut. R.A.

ANNUAL SUBSCRIBERS.

Pollock, E., Lieut. R.A.	Sidmouth, Viscount.
Cockburn, W. F., Lieut. R.A.	Miller, A. W., Commander R.N.
Nash, W., M.D., Surg.-Major A.M.D.	Adams, J. W. R., Capt. 3rd Batt. Berks
Codd, A. P. Lieut. R.E.	Regt.
Haynes, A. E., Lieut. R.E.	de Winton, C., Lieut. Hamps. Regt.
Caldecott, T., Vet. Surg. Vet. Dept.	Douglas, J. C., Lt.-Col. Worcester Regt.
Williams, O., Major Suff. Regt.	Carrington, E., Major Worcester Regt.

PROVISIONAL MEMBERS.

Versturme, H. P., Cadet R.M. Coll.	Chapman, F. H., Cadet R.M. Coll.
------------------------------------	----------------------------------



OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE RUSSIAN ARMY IN 1882.

(Continued from No. CXX.)

By Colonel SIE LUMLEY GRAHAM, Bart.

PART III.

(Conclusion.)

The Reserve.

THE Russian soldier, as we have already explained, after completing his service with the colours passes into the reserve, in which he, as a general rule, remains nine years, during which time he is considered to be on permanent furlough, is under civil law, and may pursue any occupation. His family is assisted by the municipal authorities if he is called out to join the army in the field. He is liable to be called out twice for training during his reserve service, each time for a period not exceeding six weeks.

The reserve is divided into three classes; the first consists of soldiers who have not completed eight years of total service, and furnishes on mobilization the men required to raise the standing army to its war establishment. The second class consists of soldiers between eight and twelve years' total service, and feeds the dépôt battalions which are formed on mobilization and from which losses in the field are made good. The third class, composed of men between twelve and fifteen years' service, forms on mobilization separate reserve units—infantry, field artillery, and engineers, for which the cadres exist in peace-time. There are at present no cadres for reserve cavalry or horse artillery, but the question of their formation is under consideration.

Before the last organic changes there existed eighty-two reserve battalions, each of which contained the cadres for the dépôt battalions of two infantry regiments, into which they expanded on mobilization, having during peace-time been employed in garrison and escort duties; but at the termination of the last Russo-Turkish War the various new reserve units above alluded to were organized, and these we now proceed to describe.

The Reserve Cadres Infantry Battalions.

These are 97 in number (1 of the Guard and 96 of the Line). Each battalion consists of five companies, each of which is the nucleus of a battalion, to be completed on mobilization to the strength of about 1,000 men. Battalions thus formed will consist of four companies and will be grouped by fours into reserve regiments, which will take up their numbering in succession to the field infantry regiments from 165 to 260. The fifth company of each reserve

cadre battalion will develop into the depôt battalion of the regiment formed out of its sister companies, being besides available for garrison duties. Four of these reserve regiments will form in time of war a reserve infantry Division, of which there will be twenty-four, numbered from 42 to 65. To each of these reserve Divisions will be attached one of the reserve artillery brigades, which will be hereafter described, the body of troops thus organized being sent to one of the field armies or employed to guard the frontier or to garrison a fortress, according to circumstances.

Reserve Divisions may also be grouped into army corps. The reserve cadres battalions are equipped, trained, and organized in the same manner as battalions of the field army, take part in the annual manoeuvres, and are rather inclined to consider themselves picked troops, but some of the conditions of their service are calculated to impair their military efficiency, as they are broken up into detachments sometimes spread over a considerable area, and are called upon to perform the duties which formerly devolved upon the local corps, most of which have been disbanded. This arrangement places them in a sort of nondescript position, the greater part of their time being devoted to garrison, escort, and transport duties, in the performance of which they are under the local military authorities, that is to say, the district military commandants, whilst their own commanding Officers are responsible only for their tactical training, being expected to visit and inspect their outlying detachments four times a year. In case of war these detachments will assemble at the battalion headquarters, where they will be completed to the full strength, instructions for carrying out which measure will be given in good time by the "General-Governors." The greater part of the reserve troops are quartered in the districts nearest to the probable seat of war (the western and south-western districts) (*vide* table accompanying map), and would furnish in case of need an important reinforcement to the field armies. Reserve troops sent to the front will be replaced by temporary levies raised by the local authorities, which levies will be equipped from the magazines of the disbanded local corps, but no Officers have as yet been told off for them.

On mobilization the reserve infantry available will be as follows:—

24 Reserve Divisions, each of—

	Battalions.
16 battalions	384
5 Guard battalions	5
96 Line Reserve depôt battalions	96
	485

The establishments of reserve infantry units are as follows:—

	Officers.	Classed Officials.	Non-commissioned officers.	Drummers, &c.	Lance-corporals and privates.	Total combatants.	Non-combatants.	Grand total.
Peace—								
Reserve cadre battalions	29	3	35	11	445	523	31	554
War—								
Reserve infantry regiment	63	7	320	34	3,472	3,896	116	4,012
„ depôt battalion	16	2	80	9	868	975	23	998

Reserve Field Artillery.

In peace there are six reserve artillery brigades of six batteries each. A reserve battery has four guns horsed in peace and eight in war. One battery of each brigade has 4·2-in. guns, three batteries have 3·42-in. guns, identical with the heavy and light field guns of the field artillery. The remaining two are temporarily armed with bronze guns, 9-prs. and 4-prs., but will eventually receive steel guns like those of the ordinary field batteries.

On mobilization each division will be expanded into a battery, and thus the 36 reserve artillery batteries represent 144 batteries on the war footing. 96 of these batteries are formed into 24 reserve brigades of one heavy battery and three light batteries, these brigades being numbered from 42 to 65, corresponding to the numbers of the reserve infantry Divisions.

The remaining 48 batteries form 6 dépôt brigades.

Establishment of Reserve Artillery Units in Peace and War.

	Officers.	Classed officials.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total combatants.	Non-combatants.	Grand total.	Horses.
Peace.									
Staff of reserves—									
Artillery brigade	3	4	..	1	..	8	15	23	1
Heavy battery	11	..	16	3	165	195	21	216	55
Light „	11	..	16	3	145	175	21	196	46
War.									
Staff of reserves—									
Artillery brigade'	3	4	..	1	..	8	17	25	1
Heavy battery	6	..	20	3	195	224	13	237	178
Light „	6	..	20	3	162	191	13	204	151

The carriages of a reserve battery are as follows :—

	Heavy.		Light.	
	Peace.	War.	Peace.	War.
Gun-carriages	4	8	4	8
Spare „ .....	..	1	..	1
Ammunition wagons .....	..	12	..	8
Store wagons .....	..	3	..	3

The train of a reserve battery is the same as that of a field battery.

The reserve artillery brigades are to be stationed at the following places in peace-time :—

Muraviev, Düna burg, Smolensk, Kursk, Taganrog, and Serpukhow.

Every reserve battery maintained during peace is to be provided with the complete *matériel* for the reserve or dépôt batteries, which are to be formed

from it on mobilization. The men will be furnished by the Third Class of the Reserve.

Reserve Engineers.

On mobilization, one company is taken from each of the sapper battalions of the field army, either to be expanded into two reserve sapper companies or as the nucleus of a depôt sapper battalion.

The thirty-four reserve companies thus formed are intended for service in the fortresses or on the line of communication, and to strengthen the engineer troops employed in sieges. All *matériel* required for the reserve sapper companies will be maintained in time of peace by the field battalions. The train of the reserve sapper company is the same as that of a field company.

Establishment of a Reserve Sapper Company in War.

				<i>Horses.</i>		<i>Carriages.</i>	
Officers	....	....	4	Saddle	.... 1	Two-horse	.... 2
Non-commissioned officers	20			Draught	.... 16	Four-horse	.... 3
Drummers	....	....	2		—		—
Lance-corporals and privates	....	....	215	Total	.... 17	Total	.... 5
Total combatants	....	....	241				
Non-combatants	....	....	6				
Grand total	....	....	247				

The total reserve engineer force organized on mobilization will thus amount to about as follows :—

Combatants	.... 8,194	Horses	.... 578	Carriages	.... 170
Non-combatants	.... 204				
Grand total	.... 8,398				

Summary of the Reserve Formations.

The reserve forces are approximately as follows, including non-combatants :—

In peace :—

97 battalions of infantry (554)	....	....	....	....	53,738
6 brigades of artillery (1,239)	....	....	....	....	7,434
					61,172

In war :—

96 reserve infantry regiments (4,012)	....	....	....	....	385,152
101 reserve depôt battalions (998)	....	....	....	....	100,798
24 brigades of reserve artillery (907)	....	....	....	....	21,768
34 reserve sapper companies (247)	....	....	....	....	8,398
					516,116

The number of reserve men required on mobilization to complete the reserve formations will thus be—

For Infantry	....	....	....	....	....	....	422,212
Artillery	....	....	....	....	....	....	14,334
Engineers (in addition to the peace strength of the field companies which serve as nuclei)	....	....	....	....	....	....	5,338
							<hr/> 451,884

The third class from which the men for these reserve formations would be drawn is at present calculated at a strength of 588,600, after deducting 10 per cent. for deaths, &c., so that there appears to be a sufficient margin unless anything like a general mobilization of the field army were required, when it would have to draw largely upon the third class of the reserve for some years to come, as the reserve of all classes on the 1st January, 1881, only amounted to 1,009,032, and as about 1,410,000 men are required to make up the field troops alone to their war establishment. In 1889, however, when the army organization should attain its full development, it is calculated that the total force of the reserve will reach 1,879,000, which will probably suffice even for the wants of the Russian Empire.

Depôt Troops.

Depôt troops are maintained for the purpose of keeping the field army up to its strength after mobilization, and are composed of men taken from the second class of the reserve. Cadres are maintained in time of peace for the depôts of all arms, except the engineers, each unit having at all times a permanent establishment of instructors, and in war-time a variable establishment of recruits.

Infantry Depôts.

164 cadres are maintained in peace-time for the formation of depôts for the line infantry regiments on the outbreak of war. Of these, 58, being local corps which escaped disbandment when the new organization came into force, are independent units which perform local duties, and 106 are small cadres composed of men selected from the disbanded local corps attached to the Staff of the District Commandants. It is part of the duty of these Officers to organize the depôt battalions of the field regiments belonging to their districts, at the headquarters where the stores and armouries of these battalions are placed. In case of mobilization the field regiments will detail a proportion of Officers and non-commissioned officers to the depôt battalions, which will then be filled up as quickly as possible with reserve men, and kept up if necessary by fresh drafts of recruits.

Depôt battalions are, as a rule, stationed in the recruiting districts of the regiments to which they belong, but this does not apply to Poland and the Baltic provinces, there being no depôts in those regions, the reserve men from which are distributed over the whole Empire.

The Guard regiments and other corps which have no special recruiting districts detach small cadres on mobilization as nuclei for their depôt battalions.

There will be in war-time—

12 Guard depôt battalions.		
16 Grenadier depôt battalions.		
7 rifle	"	"
164 line	"	"
<hr/>		
199 depôt battalions.		

Each battalion will have 4 companies except the Guard rifle battalion, which will only have 3 companies.

The 58 independent cadres have peace establishments varying from 1 Officer and 71 non-commissioned officers and men to 1 Officer and 178 non-commissioned officers and men, according to local requirements for the special duties performed in peace-time. Finland line rifle battalions have each a small cadre of 28 of all ranks.

Establishment of Depot Battalions.

	Combatants.					Non-combatants.		Grand total.
	Officers.	Non-commissioned officers.	Drummers and buglers.	Rank and file.	Total.	Classed officials.	Others.	
Cadre (permanent) in peace-time.....	1	5	..	20	26	..	..	26
Depôt battalions—								
Permanent.....	13	40	4	64	121	2	28	151
Variable (maximum).....	16	60	20	900	996	..	..	996
Depôt battalion of Guard Rifles.....								
Permanent.....	11	30	6	48	95	2	24	121
Variable.....	12	60	15	675	762	..	..	762

Cavalry Depôts.

Each cavalry regiment has a depôt squadron to break the remounts. It is often stationed far away from its regiment, with which it has no connection except with reference to the remounts. For instance, most of the depôt squadrons are quartered in the Kharkov district, while the great bulk of the cavalry is on the western frontier.

The depôt squadrons of the Guard cavalry and of the Dragoons of the Caucasus are, during peace, incorporated with their regiments, but on mobilization the ten depôt squadrons of the Guard are formed into one brigade.

The depôt squadrons of the six line cavalry regiments of every two consecutive cavalry Divisions constitute a depôt cavalry brigade, which is under the immediate command of the military district authorities. In war-time, reserve men and recruits for the field regiments are armed, mounted, and, if necessary, trained at the depôts, whence they are forwarded to their corps. For this purpose each depôt squadron forms two provisional squadrons, which may also take the field as separate formations.

Staff of a Depot Brigade.

Commandant (Major-General or Lieut.-General)	1
Chief of the Staff	1
Officers on remount duty, including 1 field Officer....	6
Surgeons and V.S.	6
Armourer	1
Clerks	6
All ranks	21

Other Cavalry Depôt Establishments.

	Combatants.					Non-combatants.	Horses.
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.		
Depôt squadron—							
In peace { Permanent	7	26	4	100	137	48	124
{ Variable .....	..	..	..	30	30		
{ On remount duty .....	..	3	..	32	35	2	
Additional, variable in war .....	..	..	..	80	80		
Provisional squadron	3	28	8	220	259	12	180
Caucasus Dragoon depôt squadrons (extra)	4	..	..	..	4	16	

In a Guard depôt squadron there are two additional Officers on remount duty and their three servants. There are thirty-nine privates on remount duty in a Guard depôt squadron.

Field Artillery Depôts.

The fifth and sixth batteries of the six reserve artillery brigades maintained during peace are formed, on mobilization, into six depôt brigades of field artillery, each of which consists of eight batteries. These forty-eight batteries correspond to the forty-eight artillery brigades in Europe and the Caucasus. The first four batteries in each brigade are armed with 9-prs., the remaining four with 4-prs.

Establishment of Field Artillery Depôts.

	Combatants.					Non-combatants.	
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.	Classed officials.	Others.
Staff of a depôt brigade	3	..	1	..	4	4	17
Battery of 9-prs. or 4-prs.—							
Permanent	6	20	3	74	103	..	18
Variable establishment	4	500		504	..	..	4

Horse Artillery Depôts.

There are three depôt batteries in peace-time, the third of which is at the

same time an instruction battery. These batteries are not used as cadres for new formations, but are raised to a war-strength on mobilization. For the first and second batteries only 2 guns and 1 ammunition wagon are horsed in peace-time; but in time of war 6 guns, 9 wagons, 1 store wagon, and 1 spare gun-carriage are horsed.

Establishment of a Depot Battery.

	Combatants.					Non-combatants.	
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.	Classed officials.	Others.
Peace establishment.....	5	13	3	157	178	3	17
War establishment—							
Permanent.....	5	13	3	157	178	3	20
Variable.....	3		500		503	..	..
							3

Engineer Depôts.

On mobilization, four battalions of sappers of the line each detach a company to serve as nucleus for a dépôt battalion consisting of four companies.

Establishment of a Sapper Depot Battalion.

	Officers.	Non-commissioned officers.	Drummers and buglers.	Rank and file.	Combatants.	Classed officials.	Clerks of trains.	Grand total.
Permanent	13	40	4	120	177	3	24	204
Variable	11	40	6	740	797	..	8	805
Total.....	24	80	10	860	974	3	32	1,009

Summary of the Depot Troops, including Non-combatants.

In peace :—

	(Averaging)	
58 independent dépôt battalions	.... (125)	7,250
106 infantry dépôt cadres	.... (26)	2,756
56 dépôt squadrons	.... (252)	14,112
3 horse artillery dépôt batteries	.... (198)	594
Total	....	24,712

In war :—

198 depôt infantry battalions	....	....	(1,167)	....	231,066
1 Guard rifle depôt battalion	....	....	(883)	....	883
56 depôt squadrons	....	....	(332)	....	18,592
112 provisional squadrons	....	....	(271)	....	30,352
48 field depôt batteries	....	....	(625)	....	30,000
3 horse artillery depôt batteries	....	....	(704)	....	2,112
4 sapper depôt battalions	....	....	(1,009)	....	4,036

317,041

Supposing all these establishments were completed to this, their maximum strength on mobilization, the following numbers of reserve men would be required for the different arms :—

Infantry	....	....	....	....	221,943
Cavalry	....	....	....	....	34,832
Artillery	....	....	....	....	29,118
Engineers	....	....	....	....	3,326

289,219

Fortress and Local Troops.

These consist of infantry and artillery. Under the old system, the infantry local corps were very numerous, of various strengths, from that of a battalion downwards, and scattered over the whole Empire. There were 468 of these units in European Russia alone. These corps were recruited in the same manner as regiments of the field army, their men passing on to the reserve in due time. During peace they were used principally for garrison and escort duty, being under the local military authorities. In time of war they were completed to the war establishments, and served to maintain order at home in the absence of the field army. By the Decree of August 30, 1881, 363 of these units were disbanded, their places being taken, as already shown, by the reserve cadres infantry battalions. There still exists, however, a regiment of fortress infantry at Alexandropol in the Caucasus (if not already removed to Kars). This regiment consists of 1 battalion, in peace, with 852 of all ranks; of 3 battalions, in war, each of 1,080. Total 3,240. There are, besides, in European Russia, 104 local detachments which escaped disbandment, and which, as already noticed, take charge of the stores of some of the line infantry depôt battalions in peace, and serve as nuclei for the latter on mobilization. There are, again, in the Caucasus, 3 local battalions and 59 local detachments; in Turkestan, 3 local battalions and 20 local detachments; in Siberia, 6 local battalions and 80 local detachments. The establishments of these units vary so much in strength that it is difficult to arrive at even an approximate estimate of their total numbers, but these are reckoned to be as follows in "Armed Strength" :—

18 local battalions (750)	....	....	....	....	13,500
303 local detachments	....	....	....	....	38,227

Approximate total 51,727

Local troops are recruited in the same manner as the troops of the regular army, and are raised to a war-strength from the reserve, and, if necessary, from the Opoltschenic.

Fortress Artillery.

This has already been noticed when treating of the artillery in general.

There are, however, in addition to the fortress artillery battalions, a considerable number of local artillery detachments, of a total strength of 82

Officers and 3,797 men, distributed in very unequal numbers at seventeen stations. These detachments take charge of all artillery *matériel* stored in open towns. Their strength is not increased in time of war.

General Summary of Fortress and Local Troops.—Infantry and Artillery.

In peace :—

Fortress troops	....	....	....	28,792
Local troops	....	....	....	51,727
Total	....	....	....	80,519

In war :—

Fortress troops	....	....	....	80,007
Local troops	....	....	....	51,727
Total	....	....	....	131,734

Instructional Troops.

These consist of infantry, cavalry, artillery, and engineers, and are kept up for the purpose of maintaining uniformity of drill, and for testing the value of proposed changes in drill and equipment. With the exception of a small detachment in the Caucasus, all the instructional troops are quartered at St. Petersburg.

A variable number of Officers, non-commissioned officers, and privates from the active army are attached to them—the course of training lasting two years and a-half; the detached men being changed annually, and rejoining their regiments as instructors.

Vacancies in the permanent staff are filled by selection from the men under instruction. If necessary, the instructional troops can be mobilized.

Infantry.

1 Battalion at St. Petersburg.				1 Company at Tiflis.			
Officers	....	....	24	Officers	....	....	5
Classed officials	....	....	5	Classed officials	....	....	0
Non-commissioned officers	....	....	....	Non-commissioned officers and	....	....	....
and men	....	....	185	privates	....	....	7
Non-combatants	....	....	233	Non-combatants	....	....	50
Total	....	....	447	Total	....	....	62
Horses	....	....	6	Horses	....	....	0

The instructional battalion has four companies of infantry, one company of rifles, one company of musicians for teaching drummers and buglers, and one company of non-combatants.

The variable establishment of the St. Petersburg battalion amounts to a maximum of 82 Officers and 875 non-commissioned officers and privates, and that of the Tiflis Company to a maximum of 50 Officers and 397 men.

Cavalry.

One squadron at St. Petersburg, the permanent staff of which is as follows :—

Officers, 10; classed officials, 6; non-commissioned officers and privates, 102; non-combatants, 143. Grand total, 261.

Horses, saddle, 317; draught, 6. Total, 323.

The variable establishment amounts to about 61 Officers and 262 non-commissioned officers and privates.

Artillery.

One field battery with 4 light and 2 mountain guns horsed, and 1 horse artillery battery with 6 guns horsed, one division being Cossacks.

The permanent staff is as follows :—

Field Battery.				Horse Battery.			
Officers	...	...	8	Officers	...	...	8
Classed official	...	...	1	Classed officials	...	...	3
Non-commissioned officers and	...	...	...	Non-commissioned officers and	...	...	...
privates	...	...	45	privates	...	...	104
Non-combatants	...	...	64	Non-combatants	...	...	70
Grand total			118	Grand total			185
Horses :—				Horses :—			
Saddle	...	...	19	Saddle	...	...	99
Artillery draught	...	...	37	Artillery draught	...	...	53
Train	...	...	6	Train	...	...	6
			62				158

Officers and men are sent for instruction from every brigade of artillery of the active army, and from the reserve brigades.

Engineers.

The electrical instruction company, already noticed when treating of engineer troops generally, is stationed at St. Petersburg, and comprises as follows :—

Officers, 4 ; non-commissioned officers and privates, 240 ; non-combatants, 18. Grand total, 262. Draft horses, 4.

The course of instruction lasts for one or two years, being both theoretical and practical, and attended by both Officers and men.

Special Corps.

1. The corps of topographers.
2. The corps of couriers.
3. The company of Palace Grenadiers.
4. The pensioners.
5. The gendarmerie.
6. The disciplinary battalions.
7. The military works department.

1. The corps of topographers is under the headquarter staff, and is employed in making surveys and maps. The *personnel* consists of 339 Officers. The annual grant to the department amounts to 109,226*l.*, of which 39,711*l.* is devoted to the production of maps and plans.

2. The corps of couriers consists of picked Officers and non-commissioned officers, who are employed in carrying important despatches, and in performing orderly duties about Court. The ordinary establishment comprises 48 Officers and 81 men ; the increased establishment comprises 56 Officers and 101 men.

3. The company of Palace Grenadiers performs guard duty at the Winter Palace at St. Petersburg, and at the Kremlin at Moscow. It is recruited from the Guard, is under the Ministry of the Imperial Household, and under immediate command of one of the Imperial aides-de-camp. It is composed of :—

- 1 Colonel Commanding.
- 7 Officers.
- 16 non-commissioned officers ranking as Officers.
- 142 Grenadiers.
- 3 drummers.
- 2 flute players.
- 12 non-combatants.

Total of all ranks 183

2 x 2

4. The pensioners. This corps consists of old soldiers of good conduct who have distinguished themselves in the field. There are sixteen regiments of Caucasian Grenadiers (pensioners), having each an establishment of 12 Officers, 16 non-commissioned officers, 90 privates, 3 miscellaneous, 2 Officers' servants. Total, 123; and 4 battalions of Caucasian Rifles (pensioners), each having 5 non-commissioned officers and 65 privates. Total, 70. So that there are altogether 2,248 of these pensioners.

5. The gendarmerie. This force consists of two portions, first, the ordinary police; secondly, the military police. The former is divided into three divisions, six independent detachments, and a railway corps. The three divisions are stationed: 1, at Moscow; 2, at St. Petersburg; 3, at Warsaw; their united strength being 72 Officers, 148 non-commissioned officers, 10 trumpeters, 1,031 rank and file, 8 officials, 133 non-combatants, with 754 saddle horses, and 16 draught horses.

The total strength of the independent detachments amounts to 3 Officers, 17 non-commissioned officers, 89 rank and file, and 3 non-combatants, with 70 saddle horses and 10 draught horses.

The railway corps musters 63 Officers, 1,007 non-commissioned officers, 95 rank and file, with 12 saddle horses.

The military police form six cadres, one of which is for the Guard and is stationed at St. Petersburg. The other five are at Vilna, Warsaw, Kijev, Odessa, and Tiflis. They are under the direct orders of the Chief of the Staff of their respective districts. On mobilization each centre forms a squadron for service with the field army. The establishments are as follows:—

Combatants.	Guard.		Line.	
	Cadre in peace.	Squadron in war.	Cadre in peace.	Squadron in war.
Officers—				
Colonel commanding.....	1	1	1	1
Other Officers.....	4	7	3	9
Total Officers.....	5	8	4	10
Quartermaster-sergeants.....	2	5	2	5
Sergeants.....	28	96	28	144
Trumpeters.....	2	4	2	4
Gendarmes.....	10	—	—	—
Total combatants.....	47	113	36	163
Non-combatants.....	15	21	15	24
Horses—				
Officers'.....	5	8	4	10
Troop.....	32	105	18	153
Draught.....	3	8	3	8

The Officers are taken from the Army, in which they must have served at least five years. They must also have been educated at a middle class school, and must go through a term of probation before being finally appointed to the gendarmerie. The ranks are filled with men who volunteer from the reserve, or after final discharge. They must have good characters, and must serve five years in the corps. A gendarmerie reserve of 70 non-commissioned officers is being formed.

6. The disciplinary battalions. There are four battalions, each of four companies, stationed in Europe and the Caucasus, and three disciplinary companies in Asia. These corps receive men under sentence of court-martial, and also those removed from their regiments as refractory subjects. The Commanding Officers are specially selected. Half the permanent staff consists of non-commissioned officers who have re-engaged; the other half of men of exemplary conduct selected from regiments in the district.

7. The military works department is charged with the construction and repair of fortresses, barracks, &c., and with the care of all engineer stores. The *personnel* is divided into sections, varying much in strength and scattered over the whole Empire.

We have no information as to the composition, nor as to the total strength of this corps.

Irregular Troops.

As we have already stated, the Cossacks are usually included under this head, but for reasons which appeared to us sufficient, we classed them with the field troops of the regular army to which the bulk of them virtually belong. The only "irregular" troops properly so called which remain to be mentioned are the Caucasian Militia Corps, which are recruited by voluntary enlistment from amongst the natives, are permanently embodied, and are employed locally chiefly for police duties. They are as follows:—

The Daghestan Cavalry Regiment of 6 sotnias (793 men).

The Kutais Cavalry Regiment of 4 sotnias (652 men).

The Kuban Militia of 1 sotnia (87 men).

The Terek Militia of 11 sotnias (1,276 men).

The Daghestan Militia, 11 sotnias (1,238 men).

1st Akhaltsikh, 1 sotnia.

The Grusian drujina (dismounted regiment), 4 sotnias (in peace, 277, in war, 832).

The Grusian drujina, 4 sotnias (836 men).

The militia for Kars, 3 mounted sotnias.

The militia for Batoum, 1 mounted sotnia.

The militia for Batoum, 3 infantry sotnias.

During the Russo-Turkish War of 1877–78 some 15 to 18 regiments of irregular cavalry and several battalions of infantry were raised from among the warlike tribes of the Caucasus by offering a high rate of pay, and some of these bodies at least took part in the operations.¹

THE OPOLTSCHENIÉ.

This force corresponds to the German "Landsturm," consisting of all men fit for service between the ages of 20 and 40, whether they have served with the colours or not. They are called Ratniks, and are divided into two categories, to the first of which belong the men who have been less than four years in the force, including those who have already served their time in the army and reserve, being between 35 and 38 years of age, leaving all the remaining Ratniks to compose the second category, which is only liable to employment as a militia for home defence. The first category may, however, be used either to form distinct battalions and squadrons of the Opoltschenié or to reinforce either the field army, the reserve troops, or the depôts.

The men of this force are in great part untrained, but when the Conscription Law of 1874 is in full bearing, that is to say, in 1889, the proportion of

¹ The attack on Batoum was carried on at first by the three Georgian militia regiments, which are maintained only in a skeleton state in peace-time. They are described as being, at the time of the attack, "several thousand strong and quite irregular. The bulk of the men had never been trained to the use of arms."

those who have served in the regular army will be largely increased. The numbers of the Opoltschenië will eventually be very large, for in the three years 1874-76 the conscripts passed directly into it, as being over and above the contingent required for the regular army, numbered 1,200,000. It would be difficult to form even an approximate estimate of the total strength of the force, nor would such an estimate, even if reliable, be of any practical use, as the second category, composing the bulk of the array, can only be employed locally in case of invasion, a contingency not likely to occur except in a very small portion of the Empire. With regard to the first category, however, which, as we have seen, may be used to augment the active army, we have some definite information, being told that on the 1st January, 1881, it comprised 1,873,738 men, including about 500,000 who had been soldiers.

In 1877, during the Turkish War, 185,467 men of the Opoltschenië were actually embodied. No cadres are maintained for the force in time of peace, but the names of Officers, particularly of those of superior rank, who are to be appointed to it in case of its being called out, appear in the scheme for mobilization. Equipment of every description for some 200 battalions and some 50 squadrons is constantly maintained in the commissariat magazines (in great measure in the western provinces), the cost thereof being defrayed by the communes (*semstvos*).

In each province there is a "Chief of the Opoltschenië," who is assisted by a staff of two Officers and seven non-combatants. The force, when embodied, which can only be done by Imperial decree, is formed into battalions (called "*drujinas*," an old Slav word meaning society or association, derived from *drug*, a friend), squadrons of cavalry, called "*sotnias*" (hundreds), and marine detachments. The "*drujina*" consists of four companies. The establishments of the *drujina* and of the *sotnia* are as follows :—

	Commanding Officers.	Captains.	Sub-lieutenants.	Sergeant-majors.	Sergeants.	Corporals.	Drummers.	Buglers or trumpeters.	Privates.	Total combatants.	Surgeon.	Non-combatants.	Servants.	Troop horses.
<i>Drujina</i>	1	4	8	4	20	56	5	1	518 to 900	647 to 999	1	13	14	
<i>Sotnia</i>.....	..	1	2	1	4	8	..	1	125	142	..	4	4	134

Regimental Trains.

	<i>Drujina.</i>	<i>Sotnia.</i>
Treasure and archives wagon	1	....
Provisions and cooking-pots	4	1
Mess cart	....	1
Draught horses	15	4

The Corps of Officers.

Since the introduction of general liability for military service without distinction of class, the grade of Officer has been open to every Russian subject who possesses the very moderate degree of education demanded by regulation (see below), who has served satisfactorily for the required periods as private and non-commissioned officer, and finally who has passed the professional examination which concludes the course at the cadet schools. As, however,

an educated middle class is only now beginning to exist in Russia, and as but comparatively few conscripts (generally, as before remarked, utterly uneducated at the commencement of their service) are able during the same to qualify themselves for the educational and professional tests, the majority of the Officers has hitherto belonged to the class of hereditary nobles or to that ennobled for services, either military or civil. Notwithstanding the similarity of origin amongst the Officers of the Army, the educational level has always varied greatly, being affected less by the question of birth than by that of money, for there is in Russia a large proportion of nobles with such small means as to prevent them from giving their children the advantage of a really good education, even if they wish to do so, which is not always the case. The sons of rich parents have hitherto, as a rule, entered the Guard or the cavalry, and we find that these Officers, as well as those of the special arms, are remarkable for a high degree of education, particularly as regards knowledge of languages, whilst the great majority of their comrades had received merely elementary instruction before entering the Service. In former days the *cadet corps*, to which there were many free admissions, served as nurseries for the corps of Officers, and many of the older Russian Officers, gallant soldiers indeed, but as a rule without much theoretical knowledge, were brought up in these corps, the last survival of which are the Imperial Corps of Pages and the Cadet Corps of Finland. In place of these establishments there are now eighteen military gymnasia and eight progymnasia (preparatory schools), each of which has a complete organization, the pupils wearing uniform and being divided into companies.

In the former, boys of the noble class are received at 10 years of age and educated for the *cadet* (or so-called *war*) schools. They have to undergo an entrance examination, and the course lasts seven years. Each pupil is supposed to pay 250 roubles annually for board and instruction, but many are admitted free on account of the position or circumstances of their parents.

The course includes religious instruction, the Russian, French, and German languages, mathematics up to plane trigonometry, geography, history, gymnastics, &c., drill, the elements of the natural sciences.

There are now 6,875 pupils in these schools, of which three are at St. Petersburg, four at Moscow, and the remainder scattered over the Empire.

In the year 1880, 530 youths passed into the infantry and cavalry *war schools* and 75 into those of the artillery and engineers from the gymnasia. The *progymnasia* also take boys of about 10 years of age, principally sons of Officers and of civil officials, but in Asia without any distinction as to class. They must be able to read and write, and must know the elements of arithmetic before entering. The course lasts four years, and pupils who pay contribute 150 roubles yearly.

The total number of scholars now in progymnasia is 1,700; 290 youths joined the Army as non-commissioned officers from these schools in 1880 and 13 joined the military schoolmaster's seminary.

Pupils on completing the course pass into the "Junker" schools (*war schools*) of a lower standard. The *cadet* (or *war*) schools take boys who have passed through the *gymnasia* and educate them to be Officers. There are eight of these institutions, including the above-mentioned *Finland Cadet Corps* and the *Imperial Corps of Pages*. Of the remainder the *Paul War School* and the *Constantine War School*, both at St. Petersburg, also the *Alexander War School* at Moscow, are for infantry only and accommodate 300 pupils each; the *Nicholas War School*, at St. Petersburg, is for cavalry, and can receive 200 pupils. There is also the *Michael Artillery War School*, with 160 students, and the *Nicholas Engineer War School*, with 120 students. The course in the infantry and cavalry schools lasts two years. About 400 Officers pass annually from them into the infantry and from 80 to 90 into the cavalry. Students are admitted between the ages of 16 and 20 if they have gone satisfactorily

through one of the *gymnasias*, or through a civil upper class school, or if they have passed an entrance examination.

Students have the rank of cadet and pay 64*l.* 8*s.* each for board and instruction. There are, however, a good many free admissions. Instruction is given in all professional subjects, also in religion, modern languages, history, statistics, natural history, and chemistry.

In the cavalry schools riding and hippology are also taught. Those who pass out as "excellent" are appointed *Sub-Lieutenants*, the "very good" become *Ensigns* and *Cornets*, the "good" are called cadets, are attached to regiments, and after six months' good service are promoted to the rank of Ensign.

The course in the *artillery* and *engineer schools* lasts three years. Candidates for admission must have gained a "good" certificate at a *gymnasium* or *war school*, or must pass an entrance examination. Minimum age of admission, 17. The course of instruction is similar to that in the infantry and cavalry schools with the addition of mathematics and subjects relating specially to the scientific arms. At the end of the course students reported "excellent" or "very good" are appointed—the former *Sub-Lieutenants*, the latter *Ensigns*—in the artillery or engineers respectively; whilst those who are only "good" become cadets in the infantry or cavalry. The *Finland Cadet Corps* is at *Helsingfors*. The pupils are exclusively Finlanders, must pass an elementary examination on entering, and are received up to 12 years of age. A great many of them are on the foundation; the remainder pay 22*l.* 10*s.* annually.

There is accommodation for 120. About twelve pass out every year into the cavalry or infantry of Finland. The course lasts eight years, and includes all subjects taught in the *progymnasia*, *gymnasia*, and in the *war schools*.

The *Imperial Corps of Pages* is the most aristocratic cadet school in Russia, and is established at *St. Petersburg*. Admission is obtained only by direct order of the Emperor at between the ages of 12 and 17. The wealthy pay 116*l.* 13*s.* a-year, others are educated free of expense. Those who pass out with the best certificates are appointed *Sub-Lieutenants* or *Ensigns* in the Guard, the less successful join the line as *Ensigns*. About eighteen Officers are furnished to the Army annually from this corps.

The *Junker schools* are sixteen in number, divided pretty equally amongst the military districts, and the formation of an additional one for *Turkestan* is proposed. Those now in existence contain altogether 4,485 pupils, of whom 3,380 are for the infantry, 480 for the regular cavalry, and 625 for the *Cossacks*. In 1880, 1,284 Officers were furnished to the Army by the *Junker schools*.

Candidates for admission to them must have gone through one of the *progymnasia*, or must pass an entrance examination. Non-commissioned officers still serving are allowed to enter with a view of qualifying for the rank of Officer.

The course lasts two years, the first of which is devoted principally to general subjects, the second more especially to professional subjects. Drill, gymnastics, and fencing, and in the cavalry schools riding and vaulting, are carried on during each year's course. During the summer months the cadets join camps specially formed for them. At the termination of the first course cadets classed as "very good" are appointed *Ensigns* at once, whether there be vacancies or not; those classed as "good" are appointed as vacancies occur. The *Junker schools* are under the staff of the military district in which they are established, the first examinations being conducted by Commissions appointed by the General-Governors.

The Officers of the Russian Army may be divided into four classes with regard to their education previous to entering the Service:—

1. The few who have had an university or academical education.
2. Those who have been brought up in *gymnasia*, military or civil, in the

Corps of Pages, or the Finland Cadet Corps, and who generally join the Guard or the special arms.

3. The great majority who have received an elementary education in the lower civil schools, such as those of towns or communes, or in the military *progymnasia*.

4. The very small number who, by means of private study, or of the instruction gained in the regimental schools, have qualified for admission to the Junker schools, and have passed from them into the Army.

Drygalski gives some curious statistics as to the educational and social status of the Officers. According to him, in the year 1880, 189 volunteers joined the Guard as aspirants to the rank of Officer. Of these, 25 belonged to the first educational class, 140 to the second, and 24 to the third. In the same year 5,870 aspirants joined the rest of the Army, of whom only 46 belonged to the first educational class, 795 to the second, and 5,029 to the third. Again, three of the great categories of preparatory military schools contained the following percentage of the different social classes in 1881 :—

	War schools.	Military gymnasia.	Pro-gymnasia.
Sons of hereditary nobles	65·29	72·84	36·27
„ official nobility	5·96	10·31	13·70
„ Officers and officials	12·64	11·35	34·48
„ the clergy	2·03	0·61	2·62
„ Cossacks	4·5	0·33	6·52
„ soldiers .....	..	0·15	3·85
„ various classes	9·58	4·30	2·56

In addition to the above there was a small proportion of Southern Slavs.

We see from this table that the sons of hereditary nobles preponderate in the military *gymnasia* and in the war schools fed by those institutions, whilst the sons of official nobles and of non-titled Officers and officials form the most numerous class in the *progymnasia*, whence they pass into the *Junker schools*. If we continue our examination into the Army itself we find that the hereditary nobility hold the greater part of the commissions in the Guard, whilst in the rest of the Army they form still about one-half of the corps of Officers. At the same time, in Russia, as elsewhere, the mere aristocrat is giving way to the plutocrat, and this is shown even in the matter now before us, for it is remarked that sons of rich men, sprung from the lower class, but who made their fortunes in trade, are to be found in the most exclusive regiments of the Guard and in the cavalry, whilst, on the other hand, many a representative of the oldest and most distinguished families in the Empire is serving in an ordinary infantry regiment or vegetating in some local corps on the Asiatic frontier. Amongst these latter are many Officers of foreign extraction, particularly Germans and Poles, and to these may now be added gentlemen of Georgian, Armenian, and other Caucasian races, besides many descendants of Tartar princes, richer in titles than in roubles. It will be evident to our readers, from the sketch above given, that the Officers of a Russian regiment are not likely to form such a homogeneous body as in some other armies, and indeed, until very lately, this peculiarity was very manifest. *Espit de corps* was almost unknown. The Officers of a regiment were broken up into sets without reference to their grades, like consorting with like, and those belonging to one clique seeing but little of their other brother Officers except on duty. The events of the late war appear to have somewhat modified this state of things; in some regiments which distinguished themselves against the enemy the regimental

spirit has been developed, and the authorities appear inclined to foster this feeling, regimental casinos having been encouraged, and intercourse between Officers being more carefully regulated by the institution of regimental courts of honour, as in Germany, and by insisting upon the maintenance of a proper subordination on the part of junior Officers when mixing with their superiors off duty. Of course time is required to work any great change in this matter, but already symptoms of greater unity in the corps of Officers are visible, both in the cavalry and in the scientific corps, in the case of the former probably in great measure owing to the manner in which regiments are broken up into small detachments in country quarters, where Officers are restricted to the society of their comrades and of the neighbouring country gentlemen, whilst the higher scientific education of the artillery and engineers imparts to units of those arms a special individuality.

Rifle battalions and Grenadier regiments are considered crack corps, and Officers of local corps are inclined to look down upon those of the line, probably because the latter, being less settled, are not so well accustomed to the forms and manners of society as the former, who occupy permanent quarters in the larger garrison towns.

Pay and Allowances of Officers.

Pay.

	Normal.			Increased.		
	Old Guard.	Young Guard Artillery Technical Corps Staff.	Infantry, Cavalry, and Rifles.	Old Guard.	Young Guard Artillery Technical Corps Staff.	Infantry, Cavalry, and Rifles.
<i>Active.</i>	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
General .....	..	293 4	..	..	439 17	—
Lieutenant-General .....	..	234 12	..	..	351 17	—
Major-General .....	..	175 19	..	..	263 18	—
Colonel	118 17	118 17	118 17	187 6	187 6	187 6
Lieutenant-Colonel .....	..	91 18	91 18	..	137 18	137 18
Major .....	..	..	..	..	..	114 2
Captain	91 18	76 1	76 1	137 8	114 2	95 2
Staff (2nd) Captain	76 1	63 8	63 8	114 2	95 2	87 19
Lieutenant	63 8	58 13	58 13	95 2	87 19	80 17
Sub-Lieutenant	58 13	53 18	53 18	87 19	80 17	76 2
Ensign or Cornet	53 18	50 14	47 11	80 17	76 2	71 6
<i>Supernumerary.</i>						
General .....	..	226 13	..			
Lieutenant-General .....	..	181 10	..			
Major-General .....	..	136 6	..			
Colonel	81 13	81 13	81 13			
Lieutenant-Colonel .....	..	68 3	68 3			
Major .....	..	..	54 14			
Captain	68 3	54 14	49 19			
Staff (2nd) Captain	54 14	49 19	45 19			
Lieutenant	49 19	45 19	38 17			
Sub-Lieutenant	45 19	38 17	36 9			
Ensign or Cornet	38 17	36 9	34 2			

Every Officer is entitled to quarters, or to lodging allowance, the latter varying in amount according to the class of garrison (of which there are five) in which the Officer is quartered.

The lodging allowance of a

	£	s.		£	s.
General ranges between a maximum of....	317	0	and a minimum of	79	5
Lieutenant-General ranges between a maximum of	237	15	" "	63	8
Major-General ranges between a maximum of	158	9	" "	47	11
Colonel of a regiment ranges between a maximum of	126	16	" "	39	12
Field Officer ranges between a maximum of	79	5	" "	23	16
Captain ranges between a maximum of	47	11	" "	15	17
Subaltern " "	31	14	" "	10	14

Officers' families receive a gratuity on loss of quarters and lodging allowance in time of war.

Table Money (raised considerably in 1881).

	£	s.
General commanding an Army Corps	475	10
" " a Division	380	8
Brigadier-General	285	6
Officer commanding a regiment, or senior Staff Officer	289	2
" " an independent battalion or battery	173	11
" " a battalion of infantry or a wing of cavalry	115	10
Junior Field Officers....	86	10
Squadron or company commander	58	0
Regimental staff	43	15
Subaltern	29	0

Messing Allowances.

A messing allowance is granted in addition to table money to all Officers quartered in Eastern Siberia and also to certain subalterns in lieu of table money, to all Staff Officers, those attached to instructional corps, to commandants of fortresses, of local troops and of étappen posts. The rates are as follows :—

	£	s.
Commander of an Army Corps, or equivalent	380	8
" " a Division, or equivalent	237	15
Brigadier-General	142	13
Officer commanding a regiment	190	3
" " a battalion	95	2
" " a squadron { From 95l. 2s. down to		
" " a battery { 9l. 10s., according to		
" " a company { arm and corps.		
Subaltern	15	4

Subsistence allowance (1s. 11d. a-day for Field Officers and 11d. a-day for others) is granted during manœuvres and on some other special occasions.

On mobilization the following allowances are granted to Officers and military officials :—

A gratuity on taking the field.

Allowance in lieu of rations and forage.

Allowances to Officers' families.

The gratuity consists of a sum for an outfit varying between 48*l.* for a General to 16*l.* for a Captain, besides 24*l.* for each additional charger which an Officer has to purchase to make up the regulation number. Generals and any other Officers whose baggage does not accompany the troops are entitled to a sum for the purchase of baggage-wagons and carts.

There are also other extraordinary allowances granted on special occasions which we have not space to mention.

Forage Allowance.

All mounted Officers are obliged to keep one horse in peace-time, for which they are entitled to forage, except Commanding Officers, who procure their own forage. If a second horse is kept forage may be drawn for it.

The daily ration is as follows :—

	Oats.	Hay.	Straw.
	Pecks.	Lbs.	Lbs.
Chargers belonging to Generals, to Officers of the Staff of Infantry, and of Artillery	1·08	9	2·7
Chargers of Officers of the Guard	1·44	9	3·15
" " " Cavalry	1·35	9·03	2·47

In time of war the number of forage rations is increased, and all Officers, whether mounted or not, draw a daily allowance in money consisting of a number of portions varying according to rank, and each portion amounting to 2½*d.*

At page 150 of "Armed Strength" will be found a table showing the number of forage rations and portions to which each rank is entitled. Forage is only supplied in kind where it cannot be bought.

Servants' Allowances.

Generals are allowed three, Field Officers two, and other Officers one soldier servant each, who continue to draw the same pay as when in the ranks. Married Officers of all ranks are allowed an extra servant. The sum of 14*l.* a year is allowed in lieu of each servant not required.

Ration Allowance (daily).

	In the field.		On the march.	
	s.	d.	s.	d.
Officers commanding regiments	12	8	6	4
Other Field Officers	6	4	3	2
Captains	3	2	1	7
Subalterns	1	11	0	11

Officers as a rule provide their own rations in time of war. When this cannot be done they are entitled to the same ration as the private, with the addition of 1 lb. of meat and about half-a-pint of brandy.

Presents.

It is the custom in the Russian Army for presents to be granted to Officers by the Emperor for distribution on his birth- or name-day, and on other special occasions. No Officer may receive more than 17*l.* in any one year.

Regiments bearing the name of the Emperor receive large donations of money for distribution to all ranks on certain festivals.

It will be seen from the foregoing that though the actual pay of the Russian Officer is small it is largely supplemented by the very liberal allowances, and in fact very many, perhaps the majority, of Officers live on their pay, with all the more comfort on account of the prevailing hospitality, the houses of the well-to-do being open to the poorest Officer as long as his manners and education are such as render him fit for society. Up to the age of twenty-eight an Officer must prove that he has a private income of at least 35*l.* a-year before he is allowed to marry; after that age he need only obtain the consent of his Colonel irrespective of his means. No Officer is allowed to marry before the age of twenty-three.

Promotion of Officers.

Promotion during peace is made by the Emperor; during war by the Commander-in-Chief of an army in the field, subject to the sanction of the Emperor. In the infantry, rifles, and cavalry, promotion goes by seniority up to the rank of Captain. Officers of each rank, up to Captains inclusive, are on one general list for promotion by Divisions of infantry and cavalry and by double brigades of rifles. Above the rank of Captain promotion is by selection, all those who have held the lower rank for two years, or in the case of Captains for three years, being eligible as candidates.

In the artillery promotion goes by seniority up to Lieutenant-Colonel, above that rank by selection. Officers of the lower grade are placed on the following separate lists for promotion.

Field artillery of the Guard.			
"	"	"	line.
Horse	"	"	Guard.
"	"	"	line.
Garrison artillery.			

Engineers.

The same rules for promotion as in the artillery. There are two lists, one for the Guard battalion, the other for the remainder of the corps. Up to the rank of Captain each step of promotion takes place every two years, the requisite number of vacancies being created by placing a sufficient number of Captains and 2nd Captains on the list of candidates for promotion to field rank in the infantry or cavalry.

General Staff.

The Officers are placed on one list, getting one step every two years, if qualified, up to the rank of Captain. A Captain, after three years' service as such, and after passing a practical test as Field Officer, is promoted to the rank of Lieutenant-Colonel, after which the same rules hold good as for the rest of the Army. The Chief of the Headquarter Staff may direct junior Officers' names to be placed on the list of candidates for regimental field rank. The General Staff is recruited solely from Officers who have taken honours in the General Staff Academy. The comparative rate of promotion is considerably affected by the fact that there are no Lieutenant-Colonels or Majors in the Guard, and no Majors in the scientific corps except in that of the local engineers. Captains in the Guards, therefore, rise on promotion at once to the rank of Colonel, and those of the scientific corps to the rank of Lieutenant-Colonel, even if transferred to the line. Thus from this it arises that promotion by selection being, as we have seen, the rule in the higher ranks, there is a great opening

for pushing on young Officers from the favoured corps to the detriment of their less fortunate comrades in the mass of the Army, and a great many guardsmen particularly get promotion by transfer over the heads of older Officers. This system, no doubt, gives the authorities the power of pushing on young Officers of merit to positions of trust and responsibility, where their talents will benefit the country, and there are cases where this power is exercised, but it is to be feared that the system is worked more for the benefit of individuals than for that of the country, as it is remarked that a large proportion of the Officers thus advanced owe their promotion to Court favour and to social position rather than to professional experience or ability. After the late war the list of promotions on account of "distinguished conduct in the field" was very large, including 44 Generals, 670 Staff Officers, and 924 Field Officers; 5,474 Officers (more than 15 per cent. of the whole number), were decorated. In 1879, the number thus honoured amounted to 9,456. Profusion in the distribution of honours for military service is, however, not peculiar to Russia, but is rather a characteristic of the age we live in. In 1881, the number of Officers attached to the Imperial suite—a position which is very often the stepping-stone to high command—was as follows:—137 General Adjutants, 121 unattached Generals, 146 Field Officer Adjutants.

The following schools are available for the higher education of Officers:—

The Nicholas General Staff Academy.

This academy is at St. Petersburg, and is open to all Officers of and below the rank of Major in the line, 2nd Captain in the Guard or in the scientific corps. They must have served three years regimentally, and have passed a preliminary examination, from which, however, Officers of the St. Petersburg garrison are exempt.

The successful candidates are relieved from all regimental duties for four months, after which time they must undergo the special entrance examination at the academy. Those placed highest on the list are admitted, the remainder returning to their regiments, and being informed whether they will be allowed to compete a second time. A third attempt is never allowed. The course lasts two years, and the number of students is limited to 120, including 20 in the geodetical division. If an Officer has not made good progress at the end of his first year's course, he is sent back to his regiment, but may be allowed to come up again for the entrance examination with the consent of the head of the academy. Direct admission to the second year's course may be obtained on passing the final examination of the first year's course.

At the end of each year students are classified as "excellent," "very good," "good," and "insufficient." The first class receives on leaving the large silver medal, the second class the small one.

Those at the head of the "excellent" class receive gold medals; and, if below the rank of Major, a step of promotion, but if of that rank, one year's pay. The medallists are appointed to the General Staff as vacancies arise. The celebrated General Dragomirow, so well known as a military writer and as a tactician of the go-ahead school, is now at the head of the academy, which has gained much from his ability and practical good sense, and has become not merely a preparatory school for Staff Officers, but also an emporium of military science, by which the whole Army may profit. With this view before him, he started public lectures on interesting military subjects at the academy during winter, which lectures are largely attended—an example followed by some of the other military schools.

The Russian General Staff is now formed and regulated very much after the fashion of that of the German Army. Clerical work, which formerly took up most of the time of the General Staff Officers, now devolves upon a separate

branch of the Staff, whilst the genuine Staff Officer has time to devote himself to the more active and scientific part of his profession. The Staff Officer is obliged from time to time to join a regiment for duty, and to remain a while with it, so that he may not forget the details of regimental work, nor lose the habit of commanding men. General Staff journeys take place annually in summer months in the western frontier districts, also reconnaissances on a large scale. The winter is devoted chiefly to theoretical instruction. The instruction of the Staff Officer is very comprehensive, and it is not surprising that so large numbers of able military writers should be found in its ranks—men such as Leer, Seddeleer, Kaulbars, Lewitzki, and many others, the reputation of some of whom has extended beyond the limits of the Empire.

The *Michael Artillery Academy* is at St. Petersburg, and admits 30 Officers annually, besides 25 Cossack Officers, the course extending over two years. All artillery Officers below the rank of Staff Captain (or Lieutenant in the Guard) who have done regimental duty for two years, and have passed certain examinations, are eligible for admission. Officers of other arms are also admitted on the same terms, after doing one year's service with the field artillery.

The course of instruction includes ballistics and everything connected with the history and science of artillery, also higher mathematics, the natural sciences, geometrical drawing, and riding.

During the summer months students are sent to visit Government and private technical establishments, &c. On leaving the academy they are attached to the Guard for one year. A cross is conferred upon those who specially distinguish themselves.

The *Nicholas Engineer Academy* is also at St. Petersburg, and admits 35 Officers annually for two years. Engineer Officers are eligible for admission on the same terms as those of artillery to the *Michael Academy*. The course of instruction includes the subject of fortification in all its branches, construction of buildings, waterworks and roads, architecture, higher mathematics, geometrical drawing, geodesy, chemistry, mineralogy, military history and administration, and artillery. During summer the students are sent to visit fortifications and other engineering works. The highest on the list, on leaving, are appointed to the engineer staff, crosses being given to those specially distinguished. The remainder rejoin their regiments. Extra students are admitted to the Artillery and Engineer Academies in the same manner as to the Staff Academy.

The *Military Law Academy* is at St. Petersburg, and receives 25 students annually for two years. Officers must have served four years regimentally, have obtained certain certificates, and have passed an entrance examination, before they can gain admission. The course of instruction includes all subjects connected with Russian civil and military law, and the military codes of foreign countries.

Officers who pass good final examinations receive crosses and appointments in the judicial department of the Army.

The whole of the Officers of the Russian Army and Navy, also other Government officials, civil and ecclesiastic, are divided into classes, of which there are fourteen. The entrance examination for an aspirant of the 3rd category and the lowest (14th) class of official is the same, and a cadet passing out of one of the war schools with a 1st class certificate, but physically unfit for army service, is admitted to the 12th class of officials. If he remains in the Service he advances from class to class.

Exchanges between Officers and civil officials of the same class are allowed. A town councillor has the relative rank of Colonel, and a chief councillor that of Major-General, and, like that Officer, the title of "Excellency." You often hear in Russia a distinction between the "civil" and "military" General;

and foreigners find it hard to distinguish between the two, as they both wear somewhat similar uniforms.

Many Officers leave the combatant branch for the civil department of the Service, in that case adding a civil title to that of their military rank.

A step of rank is generally given on leaving the Service, also permission to wear uniform. If a retired Officer re-enters the Service, which happens very often, even without being called out on mobilization, he generally resumes the rank which he held on leaving it.

Officers' pensions are of two kinds : State pensions and those derived from the Pension Fund.

State pensions are given to Officers retiring after 35 years' service, or in consequence of wounds, almost amounting to the full pay of the rank conferred on retirement ; to those retiring after 25 years' service, pensions equal to half-pay.

Years spent on service in the field count double, and each month spent in the defence of Sevastopol counts as a year. Officers obliged to leave the Service in consequence of ill-health after 10 years receive a pension equal to one-third of their pay ; after 20 years, to two-thirds of it ; and after 30 years, to full pay. Should they retire from ill-health, be unable to maintain themselves, and require the care of another person, they are entitled, after 5 years' service, to one-third of their pay ; after 10 years' service, to two-thirds ; and after 20 years' service, to full pay.

Pensions from the fund vary in amount according to length of service and to the number of years during which the recipient has contributed to the fund. In case of the death of an Officer entitled to a pension it goes to his family. No pensions are given to Officers who have contributed for less than 5 years. Those who have served between 25 and 35 years are entitled to half-pay ; those who have served 35 years, to full pay. In case of wounds or incurable disease the rate of pension is calculated in all cases as for Officers who have served 35 years, and varies only according to the number of years during which the pensioner has contributed to the fund. The scale is said to have been lately raised 17 per cent. all round.

The list of reserve Officers and officials is kept in each military district. It comprises all those fit for service who have left the Army before the completion of the legal period. There is a project for adding to their numbers a special body formed of the numerous educated men who, having served in the ranks the limited term prescribed by regulation for men of their acquirements, prefer leaving the Service to accepting the commissions to which they are entitled. In 1879 the number of these valuable men thus entirely lost to the Service was 684 ; in 1880 it was 516.

The following extract from the annual Returns for 1880 is interesting as showing the gain and loss of the corps of Officers during that period :—

Gain.	Loss.
1,034 cadets serving in the ranks, appointed Officers.	Total loss from all causes 3,354
635 cadets joined direct from mili- tary schools.	"
139 retired Officers rejoined.	"
1,808 total gain.	Net loss 1,546

Consequently the 36,414 Officers on the establishment on the 1st January, 1880, were reduced to 34,606 on January 1, 1881. But the establishment had meanwhile been reduced to 35,493 ; the actual deficiency, therefore, amounted to 887. But as a further reduction in the establishment of Officers has been made during the year 1881, particularly in the departments and

staff, it is probable that this deficiency has been converted into a small surplus.

The following table shows the number of Officers and of officials employed in the various staffs and departments of the Army in 1862 and in 1881 :—

	1862.		1881.	
	Officers.	Officials.	Officers.	Officials.
I. War Ministry.....	518	1,057	560	706
	1,575		1,266	
II. Military District Staffs.....	1,239	2,963	1,284	1,606
	4,202		2,890	
III. Subordinate Departments.....	2,347	3,169	3,266	3,797
	5,516		7,063	
IV. Army Staff Departments.....	4,104	9,159	5,110	9,247
	13,263		14,357	

The Officers in 1881 under heading IV (5,110) are included in the total number of 34,606 effective Officers before shown as on the strength of the Army in that year.

It will be seen by the foregoing that there were in 1881, 2,012 more Officers and 992 fewer officials in all the various staffs, offices, and departments than in 1862.

Non-commissioned Officers and Men.

Pay is reckoned by the year, and the amount is handed over quarterly in arrear by the commander of the company, squadron, or battery in presence of the other Officers and of the serjeant-major. The rates of pay differ in the different arms.

The following table shows the daily pay of the infantry both in the Guard and in the line :—¹

	Guard.				Line.			
	d.				d.			
Sergeant-Major	3	3	4	....	2	1	3	....
Sergeant	1	3	4	....	1	3	4	....
Corporal	1	3	4	....	1	3	4	....
Lance-corporal	1	3	4	....	1	3	4	....
Privates	4	9	....	....	4	9	....	....

In time of war, on the march, and during manœuvres, these rates are increased by 50 per cent.

Instead of the rations of fresh meat and brandy formerly issued, both in peace and war, soldiers receive now a mess allowance graduated according to the market prices of the garrison towns, and ranging between 1½d. and 1d. a day for each man. This allowance is calculated to provide each man with ½ lb. of meat on 196 days of the year, the remaining 169 days being fast days.

The men get two warm meals a day, at noon and in the evening.

Certain rations are also issued in kind daily, namely, flour, 2·09 lbs., peeled barley, 0·23 lb., and salt, 0·05 lb. The men bake for themselves, and the daily ration is calculated to make 2·73 lbs. of bread or 1·67 lbs. of biscuit.

¹ Such are the rates of pay according to regulations, but it is said that practically "the only coin which finds its way into the soldier's pocket is the rouble which the Emperor orders for each man after an inspection, and money made in harvest time."

This quantity is, however, not really baked, a large proportion of the flour is sold and other articles are bought for the benefit of the mess.

Besides the bread a liquor called "Kvas" is prepared from the flour and leaven to be drunk at meal times. Every regiment or detachment is required to have on hand eight days' supply of biscuit, which is renewed every month. In case of a march five days' biscuit is carried in the regimental wagons, and three days' supply by the men. Salt meat is not used, but on the march meat is bought in the villages, or cattle are driven along with the troops. The company mess is in charge of an "Artelshtchik," who purchases provisions for it. He is elected by the privates out of their own number, and remains in office for six months.

The Guards and some other regiments have kitchen gardens. As before noticed, it is the custom to allow as many men as possible to go out to work for wages towards the end of summer. The company commander looks out for work for his men, and sees to their being properly fed; while thus employed, of the money they earn, one-third goes to the company's mess fund, one-third to the workmen, and one-third is divided amongst the whole company. In war time the scale of rations is as follows:—

Black bread, 1·8 lbs., fresh meat, when issued, 0·3 lb., or ham, 0·226 lb., spirits, 0·27 pint. Fire and light are issued to troops in barracks.

There is a summer scale and a winter scale, the length of time for which the latter is allowed depending on the latitude of the place, the Empire being divided into three zones for this purpose. The winter scale applies to the northern zone for seven months, to the central zone for six months, and to the southern zone for five months; lights are only issued in winter. Barrack accommodation is by no means generally provided, but is being extended. In many towns troops are permanently billeted on the inhabitants, who receive sums varying from 2*l.* 7*s.* 6*d.* to 15*s.* 10*d.* a year per man billeted according to local prices. The rate per troop horse is 9*s.* 6*d.* per stall per annum. In time of war and in peace-time, when troops are on the line of march, they are supplied by the inhabitants on whom they are billeted with quarters, light, fuel, heating and cooking gratis.

Forage for Government horses is issued every ten or fifteen days. The daily ration in peace-time is as follows:—

	Oats.	Hay.	Straw.
	Pecks.	Lbs.	Lbs.
Cuirassiers.....	1·35	9·03	5·31
Other cavalry.....	1·35	9·03	2·47
Artillery (riding horses).....	1·06	9·03	2·47
" (draught).....	1·06	9·03	2·47
Train.....	0·76	18·06	

Such is the ration for eleven months of the year; for one month hay only is issued to cavalry and artillery, the daily allowance being 15 lbs. As we have already noticed also it is customary to turn the horses out to grass some time in the autumn. This is an alternative to the large rations of hay which is otherwise given at that period.¹

¹ Commanding Officers draw the allowance for fuel, light, forage, and for purchase of horses, and make their own arrangements. In some cases Generals of Divisions seem to administer those funds themselves instead of allowing Commanding Officers to do so, which appears to be a mischievous interference with the responsibility of the latter.

Foraging on an extensive scale is carried on in war-time to eke out the grain rations for three days, which is carried in the intendants' wagons.

Pensions for Non-commissioned Officers and Men.

Since the introduction of short service, pensions are only granted to men who have been wounded, or who have contracted disease in the Service. These men receive three roubles a month, this amount being doubled if an attendant is required. Assistance is likewise given by Government to families of men killed in action. The municipal authorities assist the families of reserve men who are drafted into the field army. Lastly, the Committee for aiding the wounded gives pensions, procures admission to the Cheshman and Ismailoff hospitals, and obtains fitting employment for the maimed and wounded.

The Maintenance of Discipline.

Minor offences committed by non-commissioned officers and privates may be punished summarily by all in authority, from the corporal upwards, according to a fixed ascending scale, the punishments for privates being reprimands; confinement to barracks; extra fatigues and other duties, not exceeding eight days; confinement to the guard-room, for a period not exceeding one month, spirits, tobacco, and conversation with comrades being forbidden; solitary confinement on bread and water, limited to twenty days, on every third day of which the ordinary ration is allowed; solitary confinement in a dark cell, limited to eight days; one month's imprisonment on bread and water, of which two periods each of eight days, with an intervening period of the same duration, may be passed in a dark cell in solitary confinement. Such is the nature of the summary punishments. The amount which may be awarded by the different ranks ranges between one day's confinement to barracks or one extra duty, which it is within the competence of a corporal to inflict, and the maximum award which the commander of a regiment of cavalry or infantry, of a brigade of artillery or sappers, and of a detached or independent battalion may impose. Non-commissioned officers must at once report to their superiors any punishment which they have inflicted. When men have been reduced to the second class by sentence of court-martial, they are liable to corporal punishment up to fifteen lashes when awarded by the commander of a company, squadron, or half-battery; up to twenty-five lashes by the commander of a battalion, of a wing (two squadrons), or of a battery; up to fifty lashes by the commander of a regiment of cavalry or infantry, of a brigade of artillery or sappers, of a detached or independent battalion.

Sergeant-majors and re-engaged non-commissioned officers are liable to reprimand, suspension for three months or reduction, but not to imprisonment on bread and water. Other non-commissioned officers are liable to the same punishments as privates, except corporal punishment, extra fatigues, and dark cells; they may also be reduced in rank, either temporarily or permanently, or sentenced to common arrest or to arrest on bread and water.

Temporary reduction to the ranks and reduction to a lower grade of non-commissioned rank cannot be inflicted by any Officer below the rank of regimental commander or corresponding to it; permanent reduction to the ranks cannot be awarded by any Officer below the rank of Divisional General. When on the line of march, the infantry or artillery soldier who misconducts himself may, in lieu of being sentenced to arrest, be ordered to stand under arms for some hours in full marching order, and the cavalry man may, under the same circumstances, be ordered to march behind a baggage-wagon, carrying his whole kit and accoutrements.

Officers are also liable to the following summary punishments: reprimands,

either private, in presence of the other Officers of the corps, or published in orders; extra turns of duty; confinement to quarters; arrest in the main-guard or in some place set apart for the purpose, with or without a sentry at the door; suspension from command; stoppage of promotion. Sub-Ensigns and Sub-Cornets are subject to the same punishments as commissioned Officers.

No Officer under the rank of commander of a company, squadron, or battery may punish a commissioned Officer. Officers of the rank above mentioned may inflict verbal or written reprimands, two extra duties, or one day's confinement to quarters.

The powers increase with the rank of the Officer awarding punishment until we arrive at the General in command of a military district, who may inflict one month's confinement to quarters or to the main-guard on all field or company Officers; suspension from command on Generals, regimental commanding Officers, and all officials during war; and the same during peace with the sanction of the Emperor.

Courts-Martial

The Military Code of 1872 regulates the composition and proceedings of courts-martial, and indeed all matters relating to military justice. Before 1879 all trials were conducted with closed doors, but since that time, as a general rule, the courts are open, and the proceedings are published, although in certain instances, latterly of somewhat frequent occurrence, this rule has been departed from, and the old system of privacy reverted to for political reasons. The new system, now under trial for about fourteen years, is generally approved of, though there are not wanting Officers of the old school who condemn the system of publicity as detrimental to discipline, and who think that the courts err on the side of leniency.

Every body of troops whose commander exercises the power of a regimental commanding Officer has its regimental court, and every military district has its district court at the district headquarters. There is further the Supreme Court at St. Petersburg, at which appeals from the verdicts of the lower courts are tried. The procedure is as follows: any Officer in independent command may assemble a court of enquiry to investigate any charge brought against any individual under his command, and should the offender be below the rank of commissioned Officer he may send the case on for trial. Should the accused be a field or company Officer, this right, however, belongs to the General commanding the Division; if a General, to the Supreme Court; if a General commanding a district, to the Minister of War; if a General commanding an army, to the Emperor. Charges against non-commissioned officers and privates may, moreover, be investigated by a civil or a military *procurator*, the result being laid before the commanding Officer of the corps to which the accused belongs. If the said commanding Officer should take no action in the matter, it is the duty of the *procurator* to report to the Supreme Court. A *procurator* may not institute an enquiry against an Officer without the sanction of the competent military authority. In all cases the proceedings of a court of enquiry, whether convened by a commanding Officer or by a civil procurator, are submitted to a military procurator, who attaches to them his opinion as to whether the case should be sent for trial or not. In the case of a non-commissioned officer or private the commanding Officer may act against the opinion of the procurator if he remands the accused for trial, but if the procurator is in favour of that course, and the commanding Officer differs from him, the matter must be referred to higher authority, the ultimate decision resting with the Supreme Court.

The substance of the preliminary enquiry must be communicated to the accused at least seven days before the trial.

Regimental Courts.

President, a Field Officer; members, two company Officers. A Judge-Advocate assists.

The Officer commanding the regiment, or equivalent corps, appoints the president for one year, the members for six months. The Judge-Advocate may hold his appointment for two years. Regimental Staff Officers are not eligible to serve on these courts, nor Officers who have served less than two years. The names of Officers selected for the duty are submitted to the Divisional General, who has the right of veto. Regimental courts may try all cases which do not concern any civilian and where conviction does not entail loss of privilege, service in disciplinary battalions, or fines over 100 roubles.

Procedure.

The accused may conduct his own defence or may be defended by counsel, military or civilian. The president of the court conducts the proceedings. The judge, prisoner, and prosecutor may cross-examine witnesses. When all evidence is taken, the prisoner is at liberty to make a statement, after which the court retires with the Judge-Advocate to consider their verdict. The president puts the two following questions:—1. Guilty or not guilty? 2. (If guilty) What punishment is to be awarded? The majority decide; in case of equality of votes the prisoner gets the benefit. The youngest member votes first. The verdict is signed by all the judges and is at once communicated in court to the prisoner, who has the right of appeal within twenty-four hours. The verdict must also be submitted to the Officer who convened the court within three days. He may confirm it, send the case up to a higher court, increase or reduce the amount of punishment within the limits provided by law. Should the prisoner appeal, he is allowed seven days for drawing up his case, which is then sent to the higher court for decision.

Military District Courts.

Composed of temporary and permanent members, the former selected from regimental Officers by the General commanding and serving for six months. President, a General or Colonel; permanent members, 2 Field Officers and 2 military procurators; temporary members, 2 Field Officers and 4 company Officers. Total, 11 Officers. Officers of less than eight years' service or who belong to the special arms or to the staff are ineligible as temporary members.

The district court may try all cases beyond the competency of a regimental court, and may hear appeals from the latter. The procedure is the same as in the lower court.

The Supreme Court at St. Petersburg.

This is the court of appeal, the decisions of which are final. It consists of a president and four members, all Generals or other high military functionaries specially selected. The Judge Advocate General is attached to this court.

The sentences are either "capital" or "correctional." Capital sentences on all ranks are death by hanging or shooting.

Hard labour in the mines for life or for not less than 20 years.

Hard labour with dismissal from the Service.

Hard labour in a fortress for 8 to 12 years.

Hard labour in a manufacturing establishment for 4 to 8 years.

Exile to Siberia.

Sentences.

The sentence of death is now often commuted to loss of civil rights with hard labour for life or for a certain period. The correctional punishments

which may be inflicted on Officers and officials are : Exile to Siberia, with, as a rule, loss of civil rights ; confinement in a fortress for from 2 months to 4 years ; imprisonment in a penitentiary with degradation ; simple imprisonment. Should the offence not be serious enough to entail dismissal from the Service, the culprit may be sentenced to confinement in the guard-room with suspension for 3 to 6 months, or without suspension for 1 to 3 months. Fines : permanent dismissal with or without loss of rank and decorations ; reduction to the ranks with the possibility of reinstatement ; compulsory retirement for 3 years. Non-commissioned officers and men who enjoy certain privileges in consequence of previous good service are subject to the same punishment as Officers as far as applicable ; those who do not enjoy any special privilege may be sent to a civil house of correction for 1 to 4 years, or to a workshop for from 2 months to 2 years, after which they are dismissed the Service.

Lastly, all non-commissioned officers and men are liable to removal to a disciplinary battalion for 1 to 3 years with partial loss of privileges, and to be placed in the second class when they are amenable to corporal punishment ; to solitary confinement in military cells for 1 to 14 months ; to fines with the alternative of imprisonment. Men who wear decorations or good conduct stripes can only be reduced to the second class by sentence of a district court-martial, other soldiers by that of a regimental court. Continued good conduct or distinguished conduct in the field may lead to a remission of this penalty. The chief offences in the Russian Army are theft and other dishonest practices, desertion, drunkenness, and insubordination.

Courts of Honour.

These are quite of modern origin, and are convened by regimental commanding Officers for the trial of Officers, cadets, and officials accused of unbecoming conduct. The number of members is seven with a regiment, and five with a detached battalion, a brigade of artillery, &c. They are elected annually by the corps of Officers, and must be above the rank of Lieutenant. There is a preliminary enquiry instituted by the president, or by order of the commanding Officer. The court may acquit the prisoner, reprimand him, or recommend his dismissal. The accused has no appeal except on account of want of form. Should his objection be held valid, the commanding Officer may order another court to assemble. If an Officer sentenced to dismissal has served his full time, he is compulsorily retired ; if not, he is transferred to the reserve.

Military Prisons.

These are three in number, at St. Petersburg, Moscow, and Warsaw. Each has a staff of 34 of all ranks, and cells for 200 prisoners. There are also houses of detention at Tobolsk and Oust-Kamenskorsk, where altogether 800 prisoners condemned to exile in Siberia are received. The civil prisons of various kinds are also largely used for military offenders.

Supply of Horses.

A horse census is taken periodically in European Russia, usually every sixth year. In 1878 the number of horses in the whole of that part of the Empire, excluding the Caucasus, was 17,785,975. Mulhall estimates the total number of horses in Russia (including, we presume, the Asiatic provinces, at 20,000,000 in 1878, an increase of 25 per cent. over the numbers returned in 1848 (see "Progress of the World," p. 374) ; whilst M. Grebentshikoff, who is quoted at page 160 of "Armed Strength," puts the number in European Russia at 16,354,000. The same writer estimates that out of this large number, not more than 11,184,000 are fit for work, and makes out that the latter quantity is 155,196 below the number required to supply the ordinary

wants of the country, including the peace establishment of the Army, which he reckons at 80,000. Russia is, however, fortunate in being able to supplement the European supply of horses from the excellent breeds to be found in some of her settled Asiatic provinces, not to mention her latest acquisition, the Turcoman steppes, where a large supply of hardy and enduring animals is available, a supply probably not reckoned in any of the estimates above given. There can be no doubt that though none of these estimates are probably strictly accurate, the resources of the Empire in horseflesh are enormous, including a large proportion of animals fit for every description of military purpose, and, moreover, that great attention is being paid to the improvement of the ordinary Russian horse by introducing fresh blood from the steppes and from foreign countries. We will now describe briefly the system in force for supplying the Army with horses both in peace and war.

Remounts.

As already noticed, Officers are told off in each cavalry regiment to perform all duties connected with this matter. Horses are cast annually by a Commission composed of the divisional, brigade, and regimental commanders. Those which have served 12 years are first cast; after which all animals whose service ranges between 9 and 11 years are examined as well as those of shorter service reputed unfit for work from disease or other cause. The annual allowance of remounts is calculated at 9 per cent. of the establishment. The horses purchased are collected in remount depôts. The prices paid are as follows:—

					£	s.
Cuirassiers of the Guard	....	....	....	....	47	11
Light cavalry, horse and field artillery of the Guard	....				32	0
						to
Ammunition teams of the Guard	....	....	....	....	32	16
Cavalry, field and horse artillery of the line	....	....	....	....	19	6
Ammunition teams of the line	....	....	....	....	15	9
		Height.	Age.			
		Hands.				
Cuirassiers	....	15.1 to 16	4 to 7	} with a margin of 1" in height for particularly well-shaped animals.		
Light cavalry of the Guard	....	14.3 " 15.1	4 " 7			
Cavalry of the line	....	14.2 " 15.1	4 " 6			
Artillery of the Guard	....	14.3 " 15.1	4 " 7			
" line—						
Riding	....	14.1 " 15.1	4 " 6			
Draught for guns	....	13.3½ " 15.1	4 " 7			
" for wagons	....	13.3½ " 14.3	4 " 7			
Horse artillery—						
Riding	....	14.1 " 15	4 " 6			
Draught	....	14.1 " 15	4 " 7			

The horses of the engineers, except those of the regimental train, are classed as artillery horses, as we have seen, but few are maintained in peace. Grey horses are only allowed for trumpeters of all corps, and in the lancers and hussars. Artillery horses are all dark. Not more than one-third of the total number may be mares. Stallions are never taken.

Remount horses are trained at the depôt for a year, and are then handed over to the regiment. Officers' first chargers are, since September, 1881, supplied by the State, a regulation which will doubtless modify, but we know not to what extent, the old system under which Officers were allowed to

purchase horses from the ranks under certain restrictions at 3 guineas above the cost price, the amount being paid into the "Officer's remount fund," from which an Officer can borrow at 4 per cent. for the purchase of a remount. As already mentioned, a money allowance is made to an Officer at the beginning of a campaign for every additional charger he has to procure.

Requisitioning of Horses on Mobilization.

This is governed by a law passed in 1876, and applicable to the whole of European Russia, Poland, and the Caucasus, some districts being excepted. The main provisions are as follows: the Minister of War determines from the results of the census the number of horses to be furnished by each district. Certain points of assembly are appointed in each district to which owners must bring their horses on certain specified days. The price to be paid for each horse in each district is fixed beforehand by the Minister of War.

Owners who part with their horses voluntarily receive 20 per cent. in addition, besides thereby freeing two horses in the class to which the one taken belongs. There are penalties for attempting to elude the law. Horses were requisitioned in 30 governments at the commencement of the last war with Turkey; and, out of 69,906 animals required, 59,000 were parted with voluntarily. Including the Cossack forces, the number of horses in the Russian Army at the beginning of 1876 amounted to 126,426; and at the end of the war the number had increased to 383,890. It is stated that no difficulty was experienced in obtaining the number required, though the expenditure of horseflesh must have been enormous.

Mobilization.

Constituted as are now the armies of the great European Powers, there is probably no branch of administration of such vital importance to them as that which deals with mobilization.

Everything connected with the operation must be thought out and prepared most carefully beforehand. There can be no fixed rule as to procedure which will apply equally to all countries; on the contrary, the course to be adopted will vary according to the geographical, political, and social condition of each State. After all, however carefully everything may be provided for beforehand, each time a great army is mobilized, defects more or less great in the system will be revealed. If those in supreme authority be wise, they will at once take advantage of the experience thus gained to correct any errors, remembering that the fate of a campaign, and indeed of an empire, may depend upon the exactitude and rapidity of the process of mobilization.

Of all the great States, the German Empire is situated in the most advantageous manner, politically, socially, and geographically, for carrying out the work of mobilization with rapidity and order, and with the least possible disturbance to the cohesion of the different military bodies.

German administrators have made a most skilful use of their fortunate position, and have little by little worked out a system which leaves apparently no great room for improvement. All the nations which have followed the example of Germany in adopting the system of short service and general liability have more or less imitated the German process of mobilization, but not one of them has been able to adopt a custom which is almost universally prevalent in Germany and which contributes materially to the successful result of that process, viz., the custom of quartering corps permanently in the districts which supply them with recruits, and whence, on mobilization, reserve men return to the regiment—as a rule, to the companies, squadrons, and batteries in which they formerly served. The advantages of this custom are manifest, but, owing to various circumstances, neither France, Italy,

Austria nor Russia have been able to adopt it fully, and consequently each of these States is exposed to greater difficulties than Germany when called upon to mobilize its forces. In no country are these difficulties so great on the whole as in Russia; and, though we alluded to them briefly at the commencement of the first part of this article, it will be necessary to notice them in this place, more particularly as affecting the question of mobilization.

The special hindrances to this process in Russia arise :—1. From the vast extent of the Empire; 2. The want of a complete system of communications—a defect which will, however, in course of time be assuredly to a great extent remedied; 3. The unequal distribution of the population, the paucity of inhabitants in some extensive provinces rendering them unequal to the task of furnishing a number of men at all in proportion to their area; 4. The necessity for political and strategical reasons of concentrating an otherwise unduly large proportion of the military forces in the neighbourhood of the western and south-western frontiers. If the accompanying map and tables be consulted, it will be seen that comparatively large masses occupy the districts of Kijew, Odessa, Charkow, Warsaw, and Wilna, whilst troops are only thinly scattered over the rest of the European provinces, except at St. Petersburg, Moscow, and Kasan, all of which places are important military centres.¹ Two evils arise from this distribution of the Army, which is rendered necessary by circumstances: firstly, that many of the corps cannot be recruited in the districts which they occupy in peace-time, and that in consequence of their depôts being in the central or in the eastern provinces of the Empire, at distances ranging up to 1,000 and more English miles, their recruits have far to travel in order to join them; secondly, that in case of sudden mobilization (and mobilization will generally be sudden) it is impossible to allow the corps in question to wait for the reserve men from their own recruiting districts, and it will be necessary to complete them from the districts which they occupy, so that the great advantage derived from reserve men rejoining the bodies in which they formerly served will be lost. These remarks refer to the infantry, for the cavalry are, setting aside the Cossacks, chiefly recruited in the south-western provinces, whilst the Guard and the special arms, as we have already noticed when treating of the conscription, are drawn from all parts of the Empire promiscuously.

Again, from motives of policy, the reasons for which are apparent, there are certain considerable portions of the Empire which are not assigned as recruiting districts for special regiments, the men drawn from them being scattered throughout the Army. Thus, in ordinary times a Russian regiment is said to consist of from 75 to 80 per cent. of pure Russians, the balance being made up of Poles, Germans, Fins, Tartars, Jews, &c. The official Returns for 1880 show the numbers belonging to the different races enrolled that year to have been as follows :—Russians, 172,084, Poles, 16,657; Tartars, 4,542; Lithuanians, 6,738; Jews, 10,003; Fins, 3,218; Germans, 3,347; Mordra, 1,968; minor tribes, 13,120. The 22 local brigade districts into which, as stated in our remarks upon "Army Corps" in the first part of this article, the Empire is divided for *recruiting purposes*, are subdivided into subdistricts of unequal size, 528 in number, each of which is under a military Officer, who presides over a Commission for recruiting and depôts. The subdistricts are again split into sections, in greater or smaller numbers, according to the dimensions and population of the subdistrict; each section containing in the country from 8,000 to 20,000 males, and as many as 40,000 in the towns. Each section has its rendezvous; the situation of the stations being so fixed that no recruit or reserve man has more than 40 miles to travel when required to turn out.

¹ The map is a reprint (by permission) from one of those in "Armed Strength;" the tables are founded upon those given in that work.

The men are called out by Imperial order, either in whole or in part, according to requirement. Each general government receives the order for service, containing the number, arm, rank, and class of men to be called, the rendezvous and the routes. The General Governors conduct the mobilization with the assistance of the police and taxgatherers, and of the local military authorities. Officers are told off in peace-time to superintend the conveyance of the men from the rendezvous to their corps, which are always bound to report to Divisional headquarters the number of men required to complete their establishment, thus enabling the General to distribute to corps under his command the proper proportion of the Divisional quota assigned him by the chief of the district in which the Division is quartered. Every man must be summoned personally, as but few can read a printed notice, and must then report himself within the appointed time (48 hours) at the nearest police office, whence he is passed on to the rendezvous, at the public expense, if possible by railway or steamer, if not, by road, a one-horse carriage being allowed for three men. On arrival at the rendezvous the men are medically inspected, and, when necessary, furnished with sufficient clothing, formed into detachments, and forwarded without delay to their respective corps. When a detachment is at least 200 strong, it is placed under a non-commissioned officer; if 750 strong, under an Officer; if 1,000 strong, under two Officers. Since 1870, all stores required for reserve men on rejoining the colours are kept at the headquarters of corps and ready for immediate issue, so that the men can be fitted out in every way on arrival.

Reserve Officers when called out for service are allowed five days to arrange their affairs and to equip themselves, unless employed in any civil capacity, in which case they are allowed three days extra. They must travel in the speediest way to their destination, making at least 200 miles a-day by rail or from 30 to 45 miles by road.

If all arrangements are carried out according to the programme, or fairly approximating to it, the mobilization becomes a simple and speedy process as far as the *personnel* is concerned, particularly as the cavalry and horse artillery whose services are first required are kept at all times almost on a war footing as far as men, horses, and guns are concerned; but a great deal more has to be done before the different corps are ready for service. Horses have to be provided for the regimental transport, for the field artillery augmentation, for the various trains, &c., only a small number of animals being maintained for these services in peace-time. Thanks to the law passed in 1876, it is believed that the necessary supply will always be obtainable at short notice. Then again eight days' biscuit has to be baked, a work which is said to require at least fourteen days. Side-arms must be ground, for in Russia it is customary to keep them in a blunt state until the order for mobilization is issued. It is said that in 1876 each infantry regiment required six days to prepare its spare arms for service. Reserve cartridges must also be greased, an operation which on the same occasion is reported to have taken ten days. But it can hardly be imagined that these latter hindrances to rapidity of mobilization, mere relics of an obsolete system, will be allowed to continue.

The mobilization of 1876 is our only guide as to the rapidity with which this operation can be performed in Russia, and there is every reason to expect that on the next occasion it will be carried out with greater expedition, always supposing the war to be generally popular as was that against Turkey. On the 13th November a partial mobilization, affecting fifty-two governments and provinces, was determined upon, the orders for the same being despatched by telegraph, and the 14th November being named as the first day. In one town (Nishni Novgorod) the men were all assembled on the night of the 13th, in seven other towns on the following day. In the government of Smolensk the reserve men had all joined the colours on the second day, in five governments on the third day, in twelve on the fourth, in four on the fifth, in seventeen

between the sixth and seventh, in two on the eleventh, in three on the thirteenth, in two on the seventeenth.

The men came in willingly, and the late arrival of some of the contingents was partly due to bad weather and bad roads. The whole of the horses required were delivered before fifteen days had elapsed. In fourteen days at least, in twenty-one days at most, every corps told off for the army of operations was ready to take the field, and on the 10th December the first despatch of troops to Bessarabia took place. The mobilization and concentration of the army, which at first only consisted of 180,000 men, required about seven weeks.

The experience gained in 1876 does not seem to have borne good fruit if we may consider the following example of the mobilization of a field artillery brigade belonging to the Guard and stationed at Warsaw, quoted by Lieutenant v. Drygalski from the "Russian Artillery Journal" of January, 1882, as a fair sample of the manner in which corps were mobilized in 1877. The order for mobilizing the Imperial Guard was issued on the 22nd July, 1877, but had been expected for a long time, so that there had been ample opportunity to make arrangements in anticipation, a course which was indeed pursued by the local military authorities. The reserve men of the brigade in question began to come in on the fourth day, the extra horses on the eleventh day. There were thirty-three Officers above the establishment on the strength of the brigade, and though they were not all present, there were still some supernumeraries; 661 men, or about one-third of the war establishment of 1885, were wanting. According to the programme prepared long before, the brigade should have been complete on the fifteenth day, but instead of this 8 per cent. were then still deficient, and men kept coming in till the thirty-fourth day. At first it was intended to put men back into the batteries to which they had formerly belonged, but this could only be done to a small extent, for amongst the reserve men forwarded to the brigade were many old cavalry and infantry soldiers with whom, particularly with the latter, it was difficult to know what to do. Eventually, however, by judicious private arrangement between commanding Officers of the different arms, this difficulty was to a great extent overcome, and only two infantry men per battery were left. 958 additional horses were required, which, according to programme, should all have been delivered by the seventh day, but were really not complete till the thirteenth day, which is not to be wondered at seeing that they had to be collected from Petersburg, Shitomir, Staro-Konstantinow, Wladimir in Volhynia, and Lipno. When received they proved to be of very different shapes and sizes, and in consequence were not put together at all satisfactorily till the end of the third week. As regards the *matériel*, there was no hitch of any consequence, although the guns in use were changed at the last moment for those of the new pattern. But 45 per cent. of the complement of drivers, altogether sixty men per battery, had to be taught how to ride during the process of mobilization. On the 17th August, the twenty-seventh of mobilization, the batteries were for the first time able to turn out fit for service. They were inspected on the 21st, on the 23rd they marched out for exercise, and on the 24th had some target practice. They left Warsaw in twelve trains, to each half-battery a train of thirty carriages, between the 26th August and the 2nd September. The journey to the Roumanian frontier took about seven days, and the whole distance to Frateschti on the Danube was performed in ten days, so that the brigade was not assembled at its point of destination till the fifty-second day after the order for mobilization was issued.

A war against both, or even against one, of the great Central European Powers would require from the very first a much greater display of force than was judged necessary at the commencement of the Turkish War; it would probably be nearer the numbers under arms at the date of the Treaty of Berlin than those shown on paper after the first partial mobilization of

1876¹: hence the time required for getting the army ready for action would be doubtless considerably greater than on that occasion; still, allowance must be made for the greater carrying powers of the lines leading to the western frontier; for the fact that seven or eight Army Corps are permanently stationed in the military districts—Wilna, Warsaw, and Kijew—as well as a large proportion of the cavalry and horse artillery, eight and a-half Divisions, comprising 140 squadrons, in the districts of Wilna and Warsaw; and also for the probability that before the next war great improvements will be made in the machinery for mobilization.

But it is not only the corps of the field army which have to be considered; the establishment of each of these has, at the outside, to be doubled, and their situation is in other respects comparatively favourable; whereas the reserve Divisions, which have also to be prepared for war, are in a very different plight. As regards the infantry, the numbers have to be increased tenfold; in the case of the artillery eightfold, both as to men and *matériel*. Moreover, to add to the difficulties, nearly half the reserve battalions are in the western districts (twenty-eight in those of Warsaw and Wilna), and distributed by companies (see table with map). However, a simultaneous mobilization of the reserves and depôt troops, as well as of the field army, is never likely to be required. Reserve battalions and batteries will doubtless be mobilized by degrees, those on the western frontier being employed for garrison duties, whilst a reserve army will be formed from the remainder and from the Cossacks of the 2nd and 3rd categories at some central station.

Fortresses.

On the northern shore of the Gulf of Finland:—

Sweaborg, 1st class.	|	Viborg, 2nd class.
----------------------	--	--------------------

On the southern shore of the Gulf of Finland and on the Baltic:—

1st class. Kronstadt.	2nd class. Dünamünd. Dünaburg.	Of minor importance. Revel. Koberschanz.
--------------------------	--------------------------------------	--

On the Polish frontier:—

Novo-Georgievsk. Brest-Litevsk.	The Alexander citadel at Warsaw. Ivangorod. Bobruisk.	Zamosc.
------------------------------------	--	---------

From extremity of Polish frontier to the Black Sea:—

Kijew.	|	Lutzk. Bender.
--------	--	-------------------

On the Black Sea:—

Kertch.	Nicholaiev.	Odessa. Sevastopol.
---------	-------------	------------------------

In the Caucasus:—

Kars. Alexandropol.	|	Ardahan. Akhaltsikh. Erivan. Shusha.
------------------------	--	---

Also a number of mountain forts.

¹ Before the war broke out Russia had under arms 857,376 Officers and men, including Cossacks. On 1st January, 1877, this number was raised to 1,192,678; at the close of 1877 the army amounted to 1,638,395; and at the date of the Treaty of Berlin (July, 1878), to 1,831,617.

y
a
r
e
e
y
s,
e

.

men,
678;
the

1876¹ : hence the time required for getting the army ready for action would be doubtless considerably greater than on that occasion ; still, allowance must be made for the greater carrying powers of the lines leading to the western frontier ; for the fact that seven or eight Army Corps are permanently stationed in the military districts—Wilna, Warsaw, and Kijew—as well as a large proportion of the cavalry and horse artillery, eight and a-half Divisions, comprising 140 squadrons, in the districts of Wilna and Warsaw ; and also for the probability that before the next war great improvements will be made in the machinery for mobilization.

But it is not only the corps of the field army which have to be considered ; the establishment of each of these has, at the outside, to be doubled, and their situation is in other respects comparatively favourable ; whereas the reserve Divisions, which have also to be prepared for war, are in a very different plight. As regards the infantry, the numbers have to be increased tenfold ; in the case of the artillery eightfold, both as to men and *matériel*. Moreover, to add to the difficulties, nearly half the reserve battalions are in the western districts (twenty-eight in those of Warsaw and Wilna), and distributed by companies (see table with map). However, a simultaneous mobilization of the reserves and dépôt troops, as well as of the field army, is never likely to be required. Reserve battalions and batteries will doubtless be mobilized by degrees, those on the western frontier being employed for garrison duties, whilst a reserve army will be formed from the remainder and from the Cossacks of the 2nd and 3rd categories at some central station.

Fortresses.

On the northern shore of the Gulf of Finland :—

Sweaborg, 1st class.	Viborg, 2nd class.
----------------------	--------------------

On the southern shore of the Gulf of Finland and on the Baltic :—

1st class. Kronstadt.	2nd class. Dünamünd. Dünaburg.	Of minor importance. Revel. Koberschanz.
--------------------------	--------------------------------------	--

On the Polish frontier :—

Novo-Georgievsk. Brest-Litevsk.	The Alexander citadel at Warsaw. Ivangorod. Bobruisk.	Zamosc.
------------------------------------	--	---------

From extremity of Polish frontier to the Black Sea :—

Kijew.		Lutzk. Bender.
--------	--	-------------------

On the Black Sea :—

Kertch.	Nicholaiev.	Odessa. Sevastopol.
---------	-------------	------------------------

In the Caucasus :—

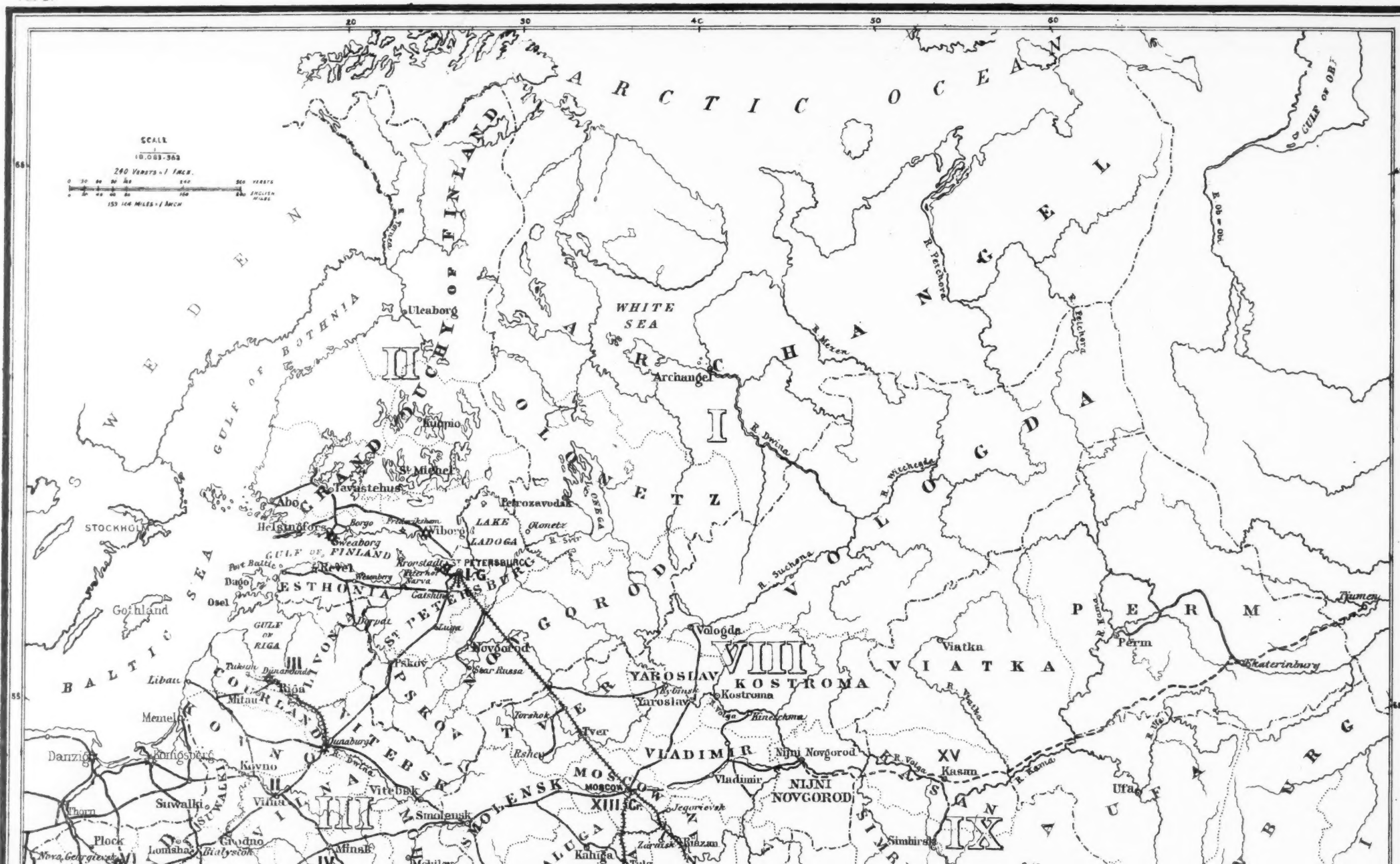
Kars. Alexandropol.	Ardahan. Akhaltzikh. Erivan. Shusha.
------------------------	---

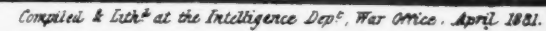
Also a number of mountain forts.

¹ Before the war broke out Russia had under arms 857,376 Officers and men, including Cossacks. On 1st January, 1877, this number was raised to 1,192,578 ; at the close of 1877 the army amounted to 1,638,395 ; and at the date of the Treaty of Berlin (July, 1878), to 1,831,617.

SHOWING MILITARY DISTRICTS & HEAD QUARTERS OF ARMY CORPS.

Plate XX.





A
L
on
D
Us
Tre
Vh
I
Go
ove
7
for
dis
mo
the
lan

fro
Jo
N

At Krasnovodsk in the Trans-Caspian district there is a small fort.

In Turkestan and its dependencies there are forts at Petro-Alexandrovsk on the Oxus, at Petrosk in the Kirghiz Steppe, at Viernoïé (in Sémerechia).

In Siberia, there are forts at Omsk, on the River Irtysh, at Semi-Palabinsk, Usk-Kamensgovsk, and at Bukhtarminsk; on the Chinese frontier at Troitzkosavsk and on the Pacific the fortified ports of Nicholaievsk and of Vladivostok.

It has been determined to construct new forts at Warsaw, Kowno, and at Gonivoz (in the Grodno district), at a total cost of 60,000,000 roubles, spread over a period of ten years.

The works at Warsaw were commenced last year (1882). Seven detached forts will be constructed on the left bank of the Vistula, at nearly 4 miles distance from the city and extending along a front of about 17 miles. Four more forts will be constructed over a mile from the former line, and again on the other side of the river at 4 miles from Praga there will be a line of four large works.

For a sketch of the whole system of Russian defences on the western frontier, see "The Russo-German Frontier in 1890," in No. CIV of this Journal, and "A Study of Operations in the Polish Theatre of War," in No. CXII of this Journal.

A.—Numerical Strength of the Russian Army, 1883.

EUROPE.

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
<i>Field Troops.</i>											
Staff of 17 Army Corps	272	595	867	..	..	272	595	867	—	—	Horses of Commanding Officers and of Staff are not shown, being private property.
41 Infantry Divisions	308,853	14,637	323,490	6,068	..	647,513	19,721	667,234	38,048	—	The 2 Guard Divisions are made into 3 in war.
32 Rifle battalions	14,848	1,056	15,904	288	..	31,392	1,408	32,800	1,952	—	Cavalry and probably Horse Ar- tillery will have above 50 per cent. added to their strength by 1889 if the augmentations contemplated are carried out.
16 (in war 17) Cavalry Div.	52,902	5,485	58,387	46,506	..	53,451	6,043	59,507	50,382	—	15 Regiments and 1 squadron of Don Cossacks are included in the Cavalry Divisions.
41 Field artillery brigades ..	43,733	3,390	47,123	12,636	984	53,461	6,678	60,142	47,408	1,968	6 Don Cossack batteries are in- cluded in the Horse Artillery.
34 Horse artillery batteries ..	5,848	714	6,562	5,474	204	6,290	1,054	7,344	8,228	204	
15 Sapper battalions	11,725	570	12,295	240	..	14,445	795	15,240	1,470	—	
4 Railway battalions*	3,848	181	4,032	116	..	4,101	181	4,288	116	—	
8 Pontonier half-battalions.	2,504	160	2,664	136	..	3,192	1,512	4,704	3,168	—	
5 Field engineer trains	285	30	315	5	..	650	700	1,350	1,350	—	
15 Telegraph trains	1,230	45	1,275	30	..	4,530	1,110	5,640	3,015	—	
4 Miner companies	520	..	520	..	..	964	..	964	—	12	
4 Torpedo companies	976	92	1,068	12	..	988	92	1,080	—	—	
1 Galvanic company (for instruction)	247	..	247	..	..	247	..	247	—	—	
Total Field Troops	447,791	26,958	474,749	71,571	1,188	821,515	39,892	861,407	155,149	2,172	

N.B.—Headquarter, administrative, medical and educational staff, intendants trains, ammunition columns, hospital and ambulance trains, are not included in this or in the following tables, but regimental trains are included.

A. 1.—Numerical Strength of the Russian Army—continued.

EUROPE—continued.

THE RUSSIAN ARMY IN 1882.

[illegible]

A. 2.—Numerical Strength of the Russian Army—continued.

CAUCASUS AND TRANS-CASPIAN.

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non com- batants.	Total men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total men.	Horses.	Guns.	
<i>Field Troops.</i>											
Staff of 2 Army Corps	28	58	86	..	..	32	70	102	—	—	
7 Infantry Divisions	52,766	2,583	55,349	1,036	..	110,523	3,360	113,883	5,208	..	
10 Rifle battalions	4,640	330	4,970	90	..	9,810	440	10,250	610	..	
3 Cavalry Divisions	12,364	1,026	13,390	11,637	..	12,566	1,125	13,691	12,371	..	
7 Field artillery brigades	7,462	574	8,036	2,163	168	10,164	1,008	11,172	11,172	336	14 Regiments, of
5 Cossack horse artillery batteries ..	980	120	1,100	855	30	980	155	1,135	1,285	30	which 10 of Cos-
2 Sapper battalions	1,430	78	1,508	32	..	1,960	106	2,066	196	..	sacks of Kuban and
1 Telegraph train	76	2	78	2	..	301	67	368	186	..	Terek; horse batte-
1 Engineer field train	42	6	48	..	..	97	139	236	230	..	ries also from
4 Frontier infantry battalions	1,848	180	2,028	112	..	3,912	300	4,212	392	..	thence.
Total Field Troops	81,636	4,957	86,593	15,927	198	150,345	6,770	157,115	31,700	366	
<i>Reserve, Fortress, and Depot Troops.</i>											
1 Fortress infantry regiment	800	52	852	..	..	3,061	179	3,240	16	..	
4 Depot infantry battalions .....	..	134	..	174	..	4,548	120	4,668	32	..	
2 Platoon battalions	1,470	264	1,604	496	..	1,426	134	1,560	174	..	
4 Cavalry depot squadrons	824	..	1,088	..	..	1,144	264	1,408	496	..	
8 Cavalry provisional squadrons .....	..	..	..	..	..	2,072	96	2,168	1,760	..	
6 Irregular cavalry regiments	4,656	237	4,893	5,151	..	4,518	273	4,791	5,297	..	
16 Fortress artillery companies	2,558	22	2,580	..	..	5,162	22	5,184	..	..
4 Sapper reserve companies .....	..	..	..	..	..	960	53	1,013	98	..	
2 Cossack horse artillery batteries ..	310	42	352	316	8	480	62	542	694	12	Kuban and Terek 2nd
5 Cossack infantry battalions .....	..	..	..	..	..	4,265	335	4,600	435	..	and 3rd categories
30 Cossack cavalry regiments .....	..	..	..	..	..	24,140	1,580	25,720	28,000	..	field class.
Total Res., Fortress, and Depot Troops	10,618	751	11,369	6,137	8	51,776	3,118	54,894	36,912	12	
Grand Total, Caucasus and Trans- Caspian	92,254	5,708	97,962	22,064	206	202,121	9,888	212,039	63,612	378	

A. 3. — *Numerical Strength of the Russian Army—continued.*

TURKESTAN.

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
Staff	52	180	232	..	..	52	180	232	..	—	
4 Battalions of rifles	1,848	140	1,988	48	..	3,912	188	4,100	312	—	
2 18 Frontier battalions	10,674	828	11,502	324	..	18,684	1,116	19,800	1,728	—	
8 Regiments of Cossack cavalry ..	6,744	422	7,166	6,910	..	6,630	458	7,088	7,061	..	From Ural, Semiritia, and Orenburg.
2 Brigades of field artillery	1,378	176	1,554	590	36	2,013	389	2,402	1,728	64	
1 Mountain horse battery											
2 Batteries Cossack horse artillery	370	46	416	322	12	410	60	500	528	12	Orenburg.
1 Half-battalion of engineers	496	34	530	52	..	496	34	530	52	—	
4 Companies of fortress artillery ..	720	32	752	..	..	720	32	752	—	—	
8 Sotnias of Semiritia Cossacks,...	..	..	..	..	..	1,230	114	1,344	1,402	—	
Total	22,282	1,858	24,140	8,246	48	34,177	2,571	36,748	12,811	76	

A. 4.—Numerical Strength of the Russian Army—continued.

SIBERIA.

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
Staff	38	129	167	..	..	38	129	167	—	—	
4 Rifle battalions	1,848	140	1,988	48	..	3,912	188	4,100	312	—	
7 Frontier battalions	3,627	318	3,945	166	..	7,026	486	7,512	680	—	
3 Battalions of Cossack infantry	2,277	70	2,347	26	..	2,986	148	3,134	103	..	Transbaikal.
3 Regiments of Cossack cavalry	2,606	165	2,771	2,713	..	2,379	201	2,580	3,111	..	Siberian.
1 Brigade of field artillery	483	64	547	140	12	760	165	925	681	24	
Independent batteries, 1 in peace, } 2 in war	173	13	186	51	4	459	77	536	489	16	
2 Batteries of Cossack horse artillery	312	42	354	252	8	484	62	546	562	12	Transbaikal.
1 Company of engineers	214	16	260	16	..	214	16	260	16	—	
1 Company of fortress artillery	305	8	313	..	..	305	8	313	—	—	
<i>Cossacks of 2nd and 3rd Categories, Field Class.</i>											
4 Battalions of infantry .....	..	..	..	..	..	3,728	156	3,884	128	..	Transbaikal.
8 Regiments of cavalry .....	..	..	..	..	..	7,254	534	7,788	8,382	..	Transbaikal and Siberian.
1 Battery of horse artillery .....	..	..	..	..	..	242	31	273	281	6	Transbaikal.
Total	11,913	965	12,878	3,412	24	29,817	2,201	32,018	14,745	58	

A. 5.—Numerical Strength of the Russian Army—continued.

RECAPITULATION.

	Peace.					War.				
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Combatants.	Non- com- batants.	Total Men.	Horses.	Guns.
<i>Europe.</i>										
Field troops	447,791	26,958	474,749	71,565	1,188	821,515	39,802	861,407	155,140	2,172
Reserve, fortresses, and depot troops	80,203	6,499	95,702	12,703	144	891,404	28,197	919,701	115,822	1,236
Total	526,994	33,457	570,451	84,268	1,332	1,712,919	68,089	1,781,108	270,971	3,408
<i>Caucasus, &c.</i>										
Field troops	81,636	4,957	86,593	15,927	198	150,345	6,770	157,115	31,700	366
Reserve depot, &c. ..	10,618	751	11,369	6,137	8	51,776	3,118	54,894	36,862	12
Total	92,254	5,708	97,962	22,064	206	202,121	9,888	212,009	68,562	378
<i>Turkistan.</i>										
Total	22,282	1,858	24,140	8,246	48	34,177	2,571	36,748	12,811	76
<i>Siberia.</i>										
Total	11,193	965	12,878	3,412	24	29,817	2,201	32,018	14,745	58
Grand Total in the Empire	662,723	41,988	705,431	117,990	1,610	1,979,034	82,749	2,061,883	367,080	3,920

B.—Strength of the different Arms,

EUROPE.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
<i>Field Troops.</i>											
Infantry	323,701	15,633	339,394	6,356	..	678,905	21,129	700,034	40,000	—	N.B.—Staff not included.
Cavalry	52,902	5,485	58,387	46,500	..	53,464	6,043	59,507	50,382	—	
Artillery	49,581	4,104	53,685	18,170	1,188	59,754	7,732	67,486	55,636	2,172	
Engineer troops.....	21,335	1,081	22,416	539	..	29,120	4,393	33,513	9,131	—	
Total field troops.....	447,519	26,363	473,882	71,565	1,188	821,243	39,297	860,540	155,149	2,172	
<i>Reserve, Fortress, and Depot Troops.</i>											
Infantry	54,995	3,007	58,002	485	..	699,926	19,305	719,231	31,806	—	
Cavalry	10,504	2,600	13,104	6,448	..	77,920	6,568	84,488	56,418	—	
Artillery	23,704	892	24,596	1,770	144	102,432	2,016	104,448	21,058	1,236	
Engineer troops.....	..	..	..	..	..	11,126	308	11,434	510	—	
Total reserve, &c., troops	89,203	6,499	95,702	8,703	144	891,404	28,197	919,601	109,822	1,236	

B. 1.—*Strength of the Different Arms—continued.*

CAUCASUS, &c.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
<i>Field Troops.</i>											
Infantry.....	59,254	3,093	62,347	1,298	..	124,245	4,100	128,345	6,210	—	
Cavalry.....	12,364	1,026	13,390	11,637	..	12,566	1,125	13,691	12,371	—	
Artillery.....	8,442	694	9,136	3,018	198	11,144	1,163	12,307	12,457	366	
Engineer troops.....	1,548	86	1,634	34	..	2,358	312	2,670	662	—	
Total field troops.....	81,608	4,899	86,507	15,927	198	150,313	6,700	157,013	31,700	366	
<i>Reserve, Fortress, and Depot Troops.</i>											
Infantry.....	2,270	186	2,456	174	..	13,300	768	14,068	657	—	
Cavalry.....	5,480	501	5,981	5,647	..	31,874	2,213	34,087	35,503	—	
Artillery.....	2,860	64	2,924	316	8	5,642	84	5,726	604	12	
Engineer troops.....	..	..	..	..	..	960	53	1,013	98	—	
Total reserves, &c.....	10,610	751	11,369	6,137	8	51,776	3,118	54,894	36,862	12	

B. 2.—*Strength of the Different Arms—continued.*

TURKESTAN.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
Infantry	12,522	968	13,490	372	..	22,596	1,304	23,900	2,040	—	N.B.—Staff not included.
Cavalry	6,744	422	7,166	6,910	..	7,860	572	8,432	8,432	—	
Artillery	2,468	254	2,722	912	48	3,173	481	3,654	2,256	76	
Engineer troops.....	496	34	530	52	..	496	34	530	52	—	
Total troops	22,230	1,678	23,908	8,246	48	34,125	2,391	36,516	12,780	76	

N.B.—Staff
included.

SIBERIA.

Infantry	7,752	528	8,280	240	..	17,652	978	18,630	1,223	—
Cavalry	2,606	165	2,771	2,713	..	9,633	735	10,368	11,193	—
Artillery	1,273	127	1,400	443	24	2,250	343	2,593	2,013	58
Engineer troops	244	16	260	16	..	244	16	260	16	—
Total troops	11,875	836	12,711	3,412	24	29,779	2,072	31,851	14,745	58
Grand total in the whole Empire, field, reserve, fortress, depot, and irregular	663,053	40,926	703,979	113,990	1,610	1,978,640	81,775	2,060,415	361,058	3,920

Distribution of the Field Troops of the Russian Army by Military Districts in 1882.

EUROPE.

District.	Corps.	Infantry.	Rifles.	Cavalry.	Field Artillery.	Horse Artillery.	Garrison Art.	Engineers.
Petersburg	Guard	8 Regts.	3 Batts.	9 Regts., 1 squad.	2 Brigades	2 Batteries	11½ Batteries	1 Battalion
Finland	I	12 "	"	4 Regts.	3 "	2 "	"	1 Brigade
Wilna	II	12 "	1 Batt. (Guard)	4 "	1 "	2 "	6 "	1 Brigade
	III	8 "	4 Batts.	4 "	2 "	2 "		
	IV	8 "	"	4 "	2 "	2 "		
	Guard	8 "	"	2 "	1 "	1 "		
Warsaw	V	8 "	8 Batts.	4 "	2 "	2 "	17 "	1 "
	VI	12 "	"	4 "	3 "	2 "		
	XIV	8 "	"	4 "	2 "	2 "		
	XI	"	"	4 Regts., Don. Coss.	—	2 "		
Kiew	XII	8 "	4 Batts.	4 Regts.	2 "	2 "	4 "	1 "
	VII	8 "	"	4 "	2 "	2 "	"	"
Odessa	VIII	8 "	4 Batts.	4 "	2 "	2 "	9 "	1 "
	IX	8 "	"	4 "	2 "	2 "	"	"
Charkov	X	8 "	"	4 "	2 "	2 "	"	"
	Grenadier	12 "	"	"	3 "	2 "	"	"
Moscow	XIII	12 "	"	4 Regts.	3 "	2 "	"	"
Kasan	XV	8 "	"	"	2 "	2 "	"	"
THE CAUCASUS.								
Caucasus	I Caucasus	8 Regts.	5 Batts.	5 Regts.	2 Brigades	2 Batteries	4 Batteries	1 Brigade
II	"	8 "	4 "	5 "	2 "	2 "	"	"
3 Independent Divs.	"	12 "	"	"	3 "	"	"	"

Distribution of Reserve, Infantry, and Artillery, and of Cavalry Depôts.

Petersburg	{ 8 Reserves cadres battalions.	10 Depôt squadrons (Guard)	1 Reserve Artillery brigade.
Finland.....	4 "	—	—
Wilna	12 "	..	1 "
Warsaw.....	16 "	—	—
Kiew	8 "	—	—
Odessa	12 "	—	{ 1 Horse Artillery battery.
Charkov	12 "	{ 6 Depôt cavalry brigades	1 Reserve Artillery brigade.
Moscow.....	12 "	1 "	{ 2 "
Kasan	12 "	..	1 Horse Artillery battery.
Caucasus .....	..	{ 1 " (Caucasians)	—

The following corrections are required in the first and second parts of this article; some in consequence of errors on the part of the author, some again in consequence of misprints, and others because of changes made in Russia since the first two parts were printed.

PART I.

Page 16, note 4. For "litter" read "the latter."

Page 17, note 3. Instead of the words which follow "regiment" read "except to the Cuirassiers of the Guard, which will retain the present organization. There will thus be altogether 328 service squadrons."

Page 18. The calibre of the light field gun is 3·42-inch instead of 2·42-in., as stated.

Page 18, note 1. For "519" read "511."

Page 24. Present war footing. Total combatants 3,909 instead of 3,911, as stated.

Page 30, line 27. After "870" insert "mounted."

Page 33, line 21. For "this" read "the."

Page 38, line 11. Omit the first "the."

Page 41, line 12 from bottom. Omit "See page 237."

Page 42, line 13. For "Russian" read "Reserve."

PART II.

Page 11. Add to the peace establishment of a heavy field battery "Volunteer 1."

For "201" read "202."

For "207" read "208."

For "236" read "237."

For "242" read "243."

Page 11, line 9 from bottom. For "172" read "173."

Page 11, line 8 from bottom. For "210" read "211."

Page 12. In the peace establishment of a horse battery—

For "28" read "40."

For "117" read "109."

Add "Volunteer 1."

For "176" read "167."

For "181" read "172."

Page 12, line 3 from bottom. For "three" read "four," for "one" read "nine,"
for "bombardier" read "bombardiers."

Page 13, line 10. For "24" read "23."

Page 13, line 12. For "15" read "21." For "26" read "31."

Add after "war," "including 1 surgeon, 1 veterinary surgeon,
1 second class riding-master."

Page 13, line 25. For "106" read "98."

Page 13, line 26. For "169" read "161."

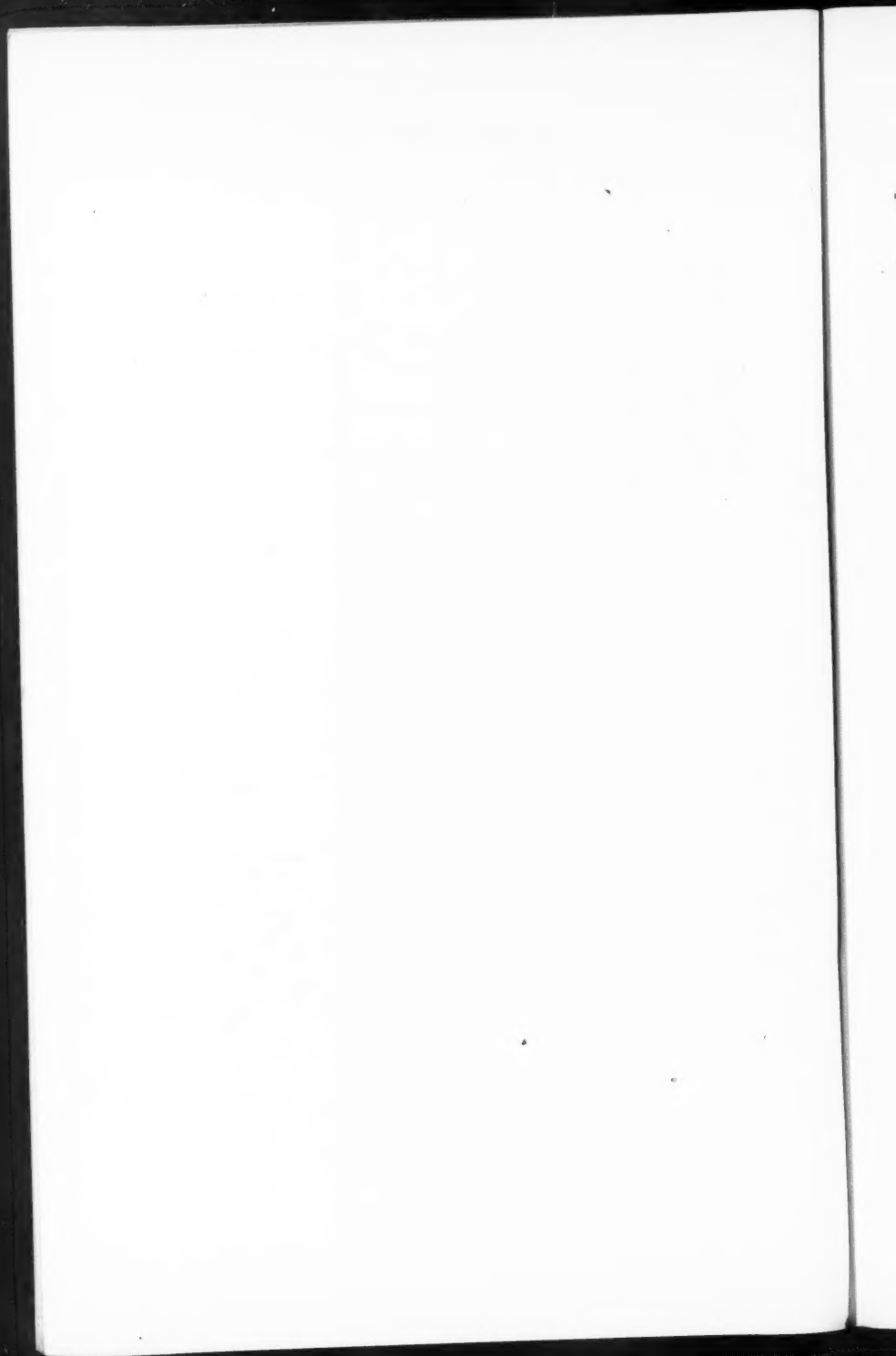
Page 13, line 27. For "107" read "99." For "103" read "123."

Page 13, line 28. For "230" read "242."

Page 21, line 4 from bottom. After "has" insert "been."

Page 29, line 3. For "185" read "189."

Page 38, line 19. Insert "2" before "staff."



THE EXPEDITION OF VON BOLTENSTERN'S DETACHMENT
IN THE LOIR VALLEY ON THE 26TH AND 27TH DECEMBER,
1870.¹

Translated from the original by Captain J. K. TROTTER, R.A., Intelligence Branch, Quartermaster-General's Department.

Note.—The Great General Staff at Berlin have very kindly given permission for a translation of the original account to be inserted in the Journal of the Royal United Service Institution; but on the distinct understanding that the translation is not to be issued separately in pamphlet shape, or to appear in any other form than as an integral part of the Journal.—L. A. H.

AFTER the battle of Beaugency-Cravant, and the engagements of the 15th and 16th December on the Loir, General Chanzy, by a well-timed retreat, succeeded in escaping the pursuit of the Germans. About the middle of December the 1st Army of the Loire under General Bourbaki became again the main object of the attention of his opponents. The 2nd Army of the Loire reached Le Mans, not without severe losses, indeed, but yet in some degree of order.

On the German side at this time the securing of the investment line of Paris on the south-west was in the first instance to be undertaken by the troops under the orders of the Grand Duke of Mecklenburg, which, with this object, were posted near Châtres. The Xth Army Corps with the 1st Cavalry Division, under the command of General von Voigts-Rhetz, remained in the space between the Loir and the Loire to cover the right flank of the IInd Army, which had its main body about Orleans, to observe the army of General Chanzy from Vendôme, and to be in a position to take advantage, by a forward movement on Tours, of any successes which might be gained.

In the carrying out of his task General von Voigts-Rhetz caused General von Kraatz-Koschlau to take post with 6½ battalions, 10 squadrons and 4 batteries at Vendôme, occupied Blois with 3 battalions, 5 squadrons, 2 batteries, and himself advanced upon Tours with 15 battalions, 12 squadrons, 9 batteries and 3 pioneer companies. On the 20th December he encountered, south of Monnaie, a hostile body of 10—15,000 men, which had recently been collected under General Ferri Pisani for the protection of the town, forced it back on Langeais, and appeared on the 21st with the heads of his columns before the gates of what had hitherto been the seat of the French Provincial Government; but withdrew again on Herbault and Blois. From these places General von Voigts-Rhetz took up once more a position of observation facing towards the west, north-west, and south-west, and, for the rest, secured for the main body of his troops here assembled the repose which was so urgently needed.

The situation of the detachment posted about Vendôme under General von Kraatz for the purpose of observing the enemy who had retreated upon Le Mans, and of maintaining communication with the Grand Duke of Mecklenburg, was less favourable. It stood in closest proximity to the main forces of the enemy, and had, moreover, to encounter many difficulties arising from the unfavourable nature of the ground.

The district north of the Loire is divided by the Loir into two parts which, in many respects, have a totally different character. Whilst south of the

¹ From "Kriegsgeschichtliche Einzelschriften." Herausgegeben vom Grossen Generalstabe Abtheilung für Kriegsgeschichte. Heft I. Berlin, 1883. See Notice in No. CXX of the Journal.

stream extend broad unbroken plains varied only by rich cultivation and numerous scattered buildings, on the north side the country forms a much intersected, wooded, hilly and undulating tract, ascending in the north to the mountains of the so-called Perche. Orchards, small patches of wood or even larger forests, intercept almost everywhere the view, and this difficulty is extraordinarily increased by numerous growing hedges. To leave the road seems frequently to be impossible. The Loir, which is passable only at the bridges, winds in and out of a sharply indented, by no means broad valley, 420 to 520 feet deep. Its banks, where the stream approaches them, slope steeply, at many points are nearly perpendicular, and almost everywhere are covered with vines.

Along this valley runs one of the main roads leading to the enemy by Les Roches, Montoire, Troo, and Sougé, whilst the other winds north of it over the high ground to Épuisay, where its distance from the first road is already about 11 miles. To a hostile population, which had taken a considerable part in the operations of minor warfare, the greatly intersected nature of the intervening country rendered it comparatively easy to keep up communication or even touch from one road to the other. To these difficulties may be added those caused by the weather. Up to December 15th it had rained, then succeeded cold weather with raw winds and snow showers which covered the roads with ice.

General von Kraatz had only some 4,000 men at his disposal. They were made up of half of the 20th Infantry Division, reinforced by two regiments of the 2nd Cavalry Brigade and two batteries of the Corps Artillery.¹

Numerous actions had, however, sensibly diminished the strength of these troops. To the bloody battles before Metz had succeeded the wearisome blockade of this fortress; the battles of Beaune la Rolande, Orléans, Beaugency-Cravant, the actions of St. Arnoud and Vendôme, and a number of smaller engagements had caused fresh heavy losses. Thus the total of the casualties incurred in action by the 39th Infantry Brigade up to the 16th December already amounted to 22 Officers and 374 men killed, and 57 Officers and 1,346 men wounded, *i.e.*, almost a third of its marching out strength. But hardships and privations had thinned the ranks even more than battles and engagements. In spite of considerable reinforcements from the Ersatz Reserve, of the troops of General von Kraatz Detachment, the 56th Infantry Regiment numbered, in the middle of December, only 1,391 combatants, the 79th Regiment, 1,436. The position of the cavalry was somewhat more favourable, yet the 3rd Cuirassiers had, of a total strength of 534, 75 sick; the 12th Lancers, 71 sick out of 516; the 2nd Squadron of the 16th Dragoons, 40 sick and detached out of 117, the 5th Squadron only 115 effective. In general, therefore, the battalions could barely turn out against the enemy 500 bayonets, and the squadrons 70-80 sabres.

General von Kraatz, therefore, sought to fulfil his task, so far as circumstances permitted him, with all possible saving of the troops. He concentrated his detachment in and about Vendôme and continued the observation of his opponent—except in so far as the minor enterprises of outposts were concerned—by means of cavalry and flying columns. The reconnaissances of the 19th December made it clear that the country as far as Mondoubleau,

¹ 39th Infantry Brigade, 2nd and 5th Squadrons of the 16th Dragoons, 4th Heavy, 4th Light, 1st and 3rd Horse Artillery Batteries of the Xth Army Corps, 3rd Cuirassiers, 12th Lancers. Till the 20th the 10th Jäger Battalion was with Von Kraatz Detachment; on the other hand, the 5th and 6th Companies 79th Regiment were absent acting as Étappen troops in Pithiviers.

On the 21st the Jäger Battalion moved off for Blois, but on the 23rd the 5th and half the 6th Company 79th Regiment reached Vendôme, the remainder of No. 6 Company being still employed as prisoners' escort.

s
r
y
e
n
d
n
e

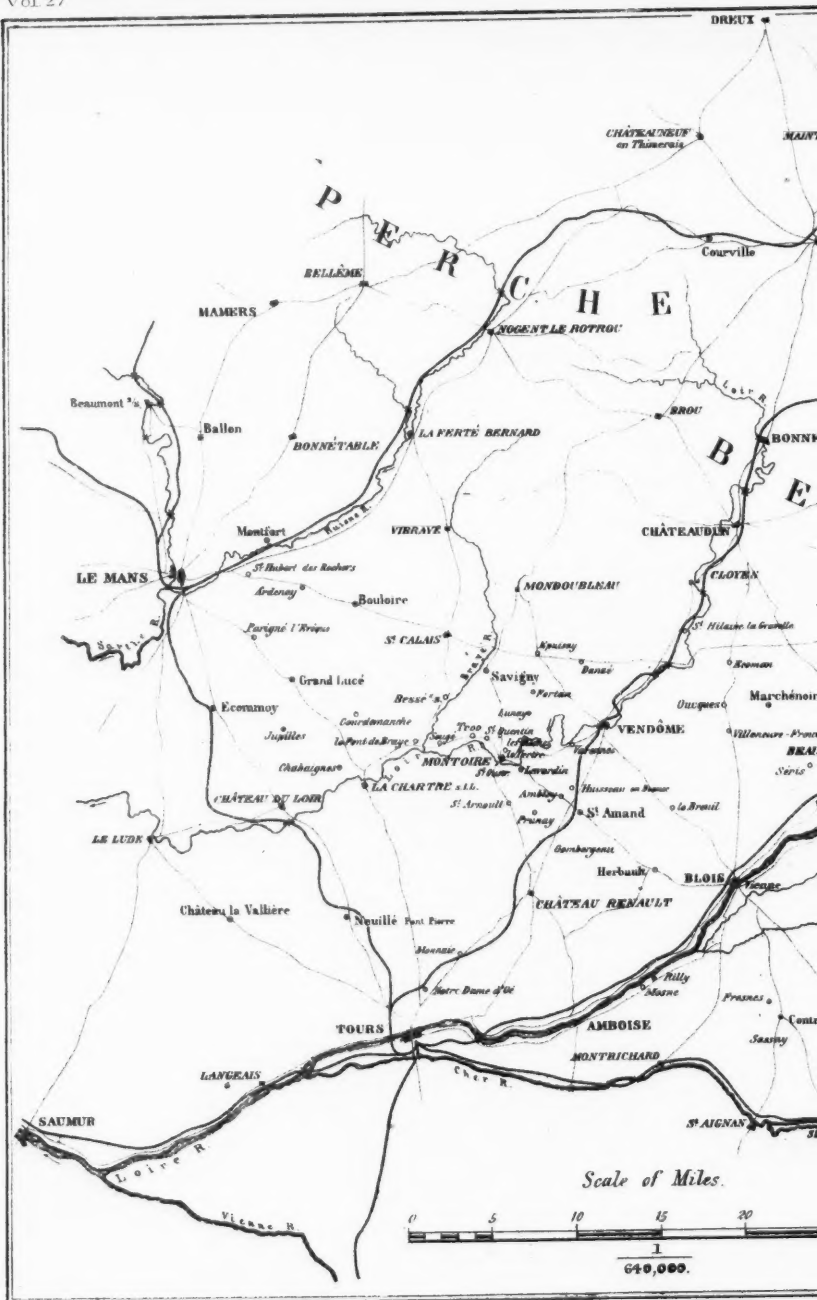
re
ts

se
k-
y-
er
es
er
nd
ut
nd
atz
ry
he
ore
he
ns,
In
my

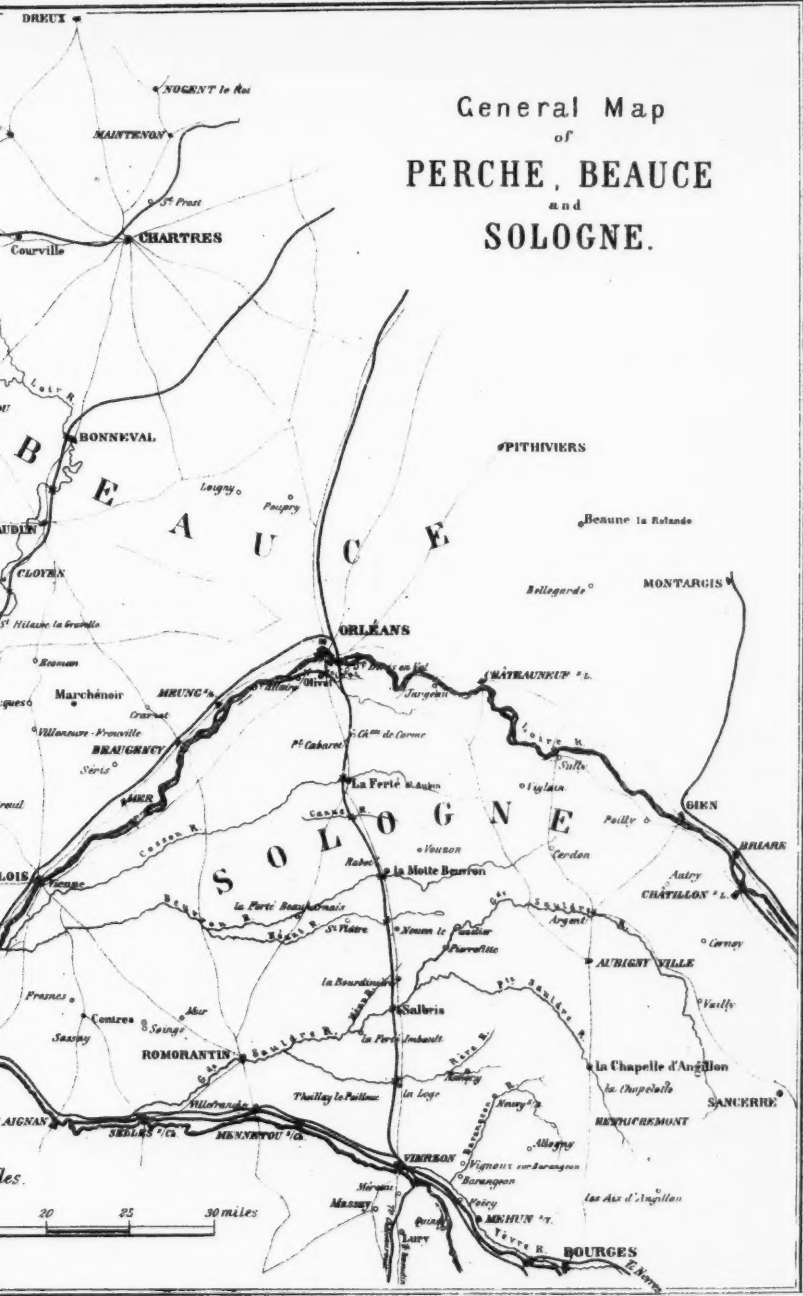
am-
en-
ion
ere
s of
eau,

avy,
3rd
Von
ment

and
No. 6



General Map
of
PERCHE, BEAUCÉ
and
SOLOGNE.



St. Calais and Savigny was clear of the enemy, whilst on the other side of St. Calais a strong hostile column was observed to be marching upon Le Mans. A flying column under Major Schmidt von Knobelsdorf, consisting of 5 companies, 2 squadrons and 2 guns, which moved off towards Montoire on the 21st December, found on 22nd December that the woods and heights of Sougé were occupied by the enemy's infantry, but succeeded in restoring the broken bridges over the Loir at Les Roches and Montoire.

On the 22nd St. Calais was found to be clear of the enemy. The inhabitants said that on the 18th large masses of troops had passed through the town, but that on the 19th and 20th only small detachments had followed. On the 23rd, however, a cavalry patrol, which had been pushed forward, was received there with fire from hostile infantry and cavalry patrols, and was forced to retire with loss. On the same day Major von Schmidt returned to Vendôme.

General von Kraatz upon this gave orders for a systematic reconnaissance, and Officers' patrols were to be sent off daily in the following directions:—

1. From the 3rd Cuirassiers:—

(a.) To Oucques, with the heads as far as Villeneuve-Frouville, Marchénoir and Ecoman;

(b.) In the direction of Cloyes as far as St. Hilaire la Gravelle; heads as far as the first place and to the flank as far as Danzé.

2. From the 12th Lancers:—

(a.) To Epuisay; heads as far as Mondoubleau, St. Calais and Savigny;

(b.) To Montoire on both banks of the Loir; heads as far as the Braye brook and flankers as far as St. Arnoult.

3. From the two Dragoon squadrons:—

(a.) To St. Arnoult, with flanking patrols as far as Château Renault and Gombergeau;

(b.) To Le Breuil.

The entire neighbourhood of Vendôme was in this way to be examined by sending forward a radiating system of patrols, and a connection was at the same time to be maintained with the neighbouring troops. General von Kraatz aimed also at pushing forward, as had been done before, flying columns in the direction of the enemy in order to prevent weak hostile forces from gradually gaining a footing in the neighbourhood of Vendôme. In this way he hoped to maintain as extended a circle of observation as possible, and at the same time to induce circumspection among such inhabitants as might be found here and there with arms in their hands. But in spite of these measures it was not possible to doubt that the opponent would ever be accurately informed by the country people of what was taking place on our side, as, in fact, he already knew well the numerical weakness of the detachment. The regularity also of the patrolling system with regard to time and place—almost all patrols being obliged to start early in order to return the same day—did not escape the attention of the watchful population.

On the 24th December Major Körber was detached to Epuisay with two battalions, two squadrons and a battery, charged with the task of driving the enemy out of St. Calais on the 25th. His patrols found Mondoubleau, Savigny and Bessé-sur-Braye clear of the enemy; St. Calais, on the other hand, was still occupied. The Lancer patrol, which moved from Vendôme on the 24th towards the Braye brook by Montoire, was received at Sougé and Troo with fire; at the latter place, however, from the country people. A trooper was here wounded and taken prisoner. On the 25th, Major Körber drove the enemy out of St. Calais by means of a few shells; but before Bouloire the pursuing squadron was forced to retire in face of a somewhat strong infantry fire. According to the reports of the inhabitants of St. Calais, the main forces of the enemy had withdrawn the previous evening in a westerly direction. Major Körber then returned for the night to Epuisay.

The results of the reconnaissances which had been carried out up to the evening of the 25th December gave no colour to the idea of the advance of considerable hostile forces in an easterly direction ; it appeared rather as if the enemy, who had been reported about Sougé, was not in strength, and possibly consisted only of bands of franc-tireurs and armed peasants. In order to clear up this point, and at the same time to punish the inhabitants of Troo and Sougé for their hostile behaviour towards his patrols, General von Kraatz resolved to send forward again, on the 26th, a flying column in the Loir valley, of the strength of six companies, a squadron, and two guns.¹

In the meantime, in the army of General Chanzy, which had reached the neighbourhood of Le Mans on the 25th December, all possible measures were being taken to enable the troops to take the field again at the earliest moment. The 21st Corps had made good its retreat by Monfort, the 17th by Ardenay and St. Hubert des Rochers, the 16th by Parigné l'Évêque. A Division of the latter Corps under General Barry, however, remained in and about La Chartre-sur-le-Loir, Chahaignes and Jupilles, in order to keep up the connection with the troops which had been recently drawn together between the Loire and the Loir to cover Tours. After that General von Voigts-Rhetz, however, had forced back these in the action at Monnaie, the French Commander resolved to draw them up northward to General Barry, so that they might cover from a flanking position the roads leading up the Loir from Tours.

For the rest, till 23rd December, General Chanzy had contented himself with pushing forward on the main roads leading to the enemy small detachments of light troops. But the action of the German flying columns soon made it necessary to have stronger detached forces available in the front. On the above-named day, therefore, General Rousseau was ordered to advance in a north-easterly direction towards La Ferté Bernard and Nogent-le-Rotrou, with a strong detachment, whilst General de Jouffroy was to push forward with the 3rd Division of the 17th Corps on the right in the direction of Château Renault.

The task of the latter General comprised the reconnaissance of the entire district between the Loir and the Loire east of the railway Le Mans—Tours, the driving away of all hostile parties, and the facilitating the restoration of

¹ The exact distribution of the Xth Army Corps and the 1st Cavalry Division on the evening of 25th December was as follows :—

Detachment of General von Kraatz.

In Vendôme.—79th Regiment, Fusilier Battalion 53rd Regiment, 3rd Squadron 3rd Cuirassiers, 3rd Squadron 12th Lancers, 2nd Squadron 16th Dragoons, 4th Heavy, 4th Light and 3rd Horse Artillery Batteries Xth Army Corps, half No. 2 Sanitary Detachment.

In Épuisay.—1st and 2nd Battalions 56th Regiment, 3rd Squadron 3rd Cuirassiers, 4th Squadron 12th Lancers, 1st Horse Artillery Battery Xth Army Corps, half No. 2 Sanitary Detachment.

Detachment of General von Diringshofen.

In Herbault.—40th Infantry Brigade, 2nd Squadron 16th Dragoons, 3rd Squadron 8th Lancers, 3rd Heavy and 3rd Light Batteries Xth Army Corps.

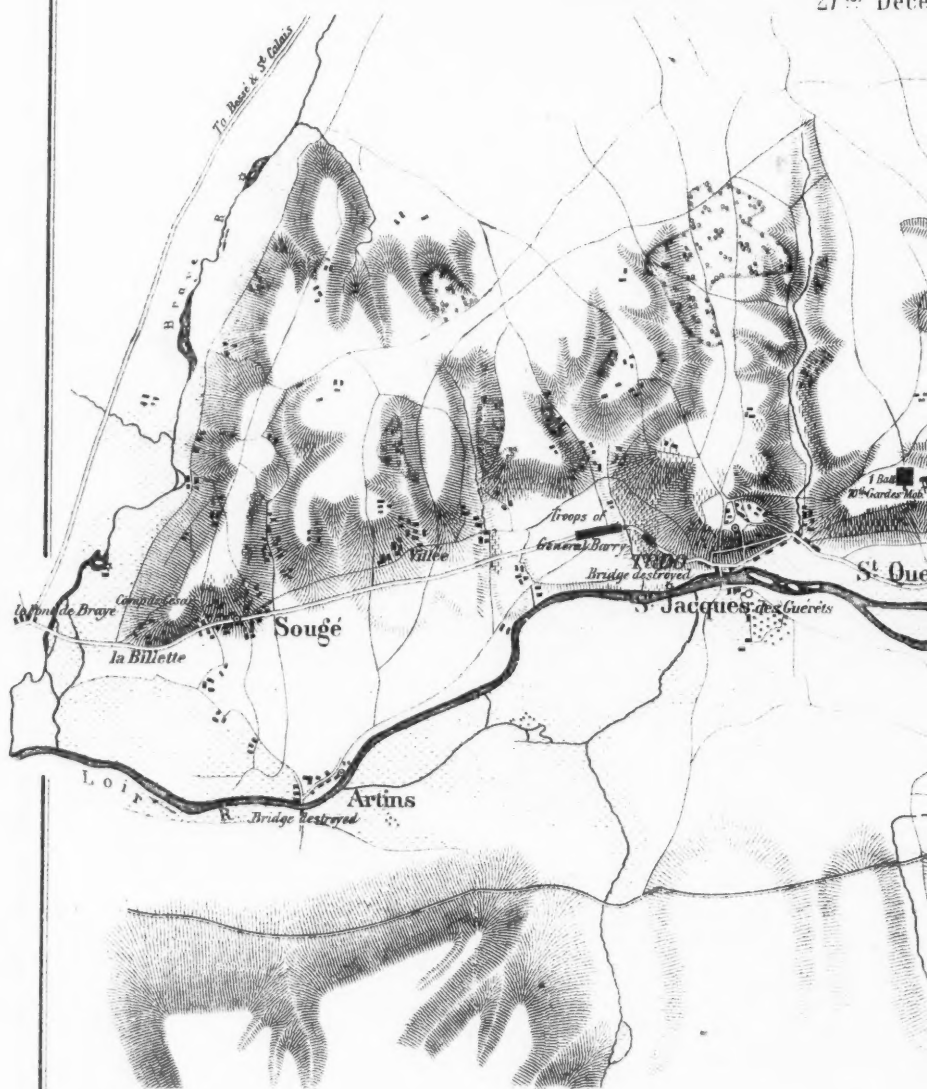
Main Body.

In Blois and Vienne.—Headquarters, Staff of 1st Cavalry Division and Corps Artillery. 19th Infantry Division, 10th Jäger Battalion, 3rd Squadron 8th Lancers, 1 pioneer company with Light Field Bridge Train, 3rd Field Division Xth Army Corps, half No. 3 Sanitary Detachment.

N. and N.E. of Blois.—1st Cavalry Brigade with 1st Horse Artillery Battery 1st Army Corps.

Sketch of the f

27th Dec



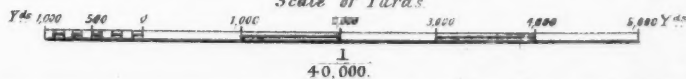
☒ Prussian troops
 ■ French ——— } at 2.30 P.M.

Note: Sufficiently exhaustive reports to distinguish French troops have not been obtained.

the fight at Montoire.

27th December 1870.

Scale of Yards

1
40,000.to distinguish all the
lined.



the railway line above named, which had been broken by General von Voigts-Rhetz. In case he considered reinforcements to be necessary, he was empowered to call on General Barry, who had occupied all the passages of the stream from Le Lude to Pont de Braye. At Château la Vallière the troops which had hitherto been under the command of General Ferri Pisani, and were now under General Cléret, were to be held ready, reinforced by 4,000 men under General Curten, who had been brought up from Chatellerault. Since, however, General von Voigts-Rhetz, as related, voluntarily retired on Herbault and Blois soon after the action of Monnaie, General Cléret was able to occupy Tours again without fighting, and General Curten took post at and in front of Neuillé Pont Pierre to cover the railway line Le Mans—Tours.

On the 24th December General de Jouffroy moved off from his quarters behind Le Mans. In accordance with an order of General Chanzy, he had left behind in their former positions all the sick and stragglers, as well as all troops whose arms were defective and who were badly shod; the men were provided with a three days' iron ration, and since the railway Le Mans—Château du Loir was available for the transport of all that was necessary, the Train could be reduced to a minimum.

General de Jouffroy had succeeded General de Flandre, who had fallen in the battle of Beaugency-Cravant, in the command of his Division, the 3rd of the 17th Corps. The Division consisted of two Brigades, with a total of thirteen battalions, three batteries and a section of Engineers.¹

For the undertaking before him 200 sabres of the Light Cavalry of the Corps were in addition attached to the Division. Brought together for the first time in the month of November, and originally designed for the occupation of the camp of Notre Dame d'Oé, it was pushed forward on the 20th November to join its Corps in the neighbourhood of Châteaudun. Continued bivouacs and numerous night marches tried severely the piecemeal organization of its troops before ever it came in sight of the enemy. In the skirmish at Brou and in the battle of Loigny-Poupry it suffered but slight losses; on the other hand, in the battle of Beaugency-Cravant on the 8th December, particularly in the attack on the latter place, undertaken with energy but completely defeated, its losses were considerable. From the effect of this day the Division appears to have recovered but slowly, at any rate its behaviour in the action of Montoire is sufficient evidence in favour of this supposition. The Bataillons-de-Marche were naturally its best elements, but even with these the great deficiency in subordinate leaders, though perhaps not so serious as with the Gardes Mobiles, had a very disadvantageous effect.

On the 24th December General de Jouffroy reached the district in front of Parigné l'Evêque; on the evening of the 25th he arrived at Courdemanche by way of Grand-Lucé. Here he learnt that in the course of the day St. Calais had been shelled by the Germans, and being in doubt whether he should continue his task or turn in the direction of that town, inquired from Le Mans concerning his further movements. In expectation of an answer he led his Division on the 26th to Bessé-sur-Braye.

General von Kraatz had appointed Lieutenant-Colonel von Boltenstern of the 79th Infantry Regiment to the command of the flying column to be sent forward to the valley of the Loir on the 26th. The Divisional order in reference to this ran as follows:—

¹ Appendix No. 1 contains the ordre de bataille of the Division. The 76th Regiment of Gardes Mobiles mentioned therein appears, however, to have been amongst the remnants of the Division which had been left behind at Le Mans by order of General Chanzy, on account of their internal condition; at least it is not mentioned in any of the French accounts which treat of the action of Montoire and of the engagements which took place round Vendôme up to the end of December.

"To-morrow, 26th, at 8.30 P.M., a detachment consisting of the half of the 2nd Battalion, and the Fusilier Battalion of the 79th Regiment, one squadron of the 12th Lancers, and two guns of the 4th Light Battery, with two wagons of the Sanitary Department properly equipped, will be drawn up on the road to Montoire under the orders of Lieutenant-Colonel von Boltenstern, 79th Infantry Regiment. Till the return of the Detachment from Épuisay the outposts will be found by the Fusilier Battalion of the 56th Regiment alone.

"The patrols to Montoire will not be sent out by the Lancer Regiment till Lieutenant-Colonel von Boltenstern's return, which presumably will take place on the 28th."

The whole of the 2nd Battalion 79th Regiment was afterwards detailed to the Detachment by verbal order.

For the sake of giving more definite instructions General von Kraatz summoned Lieutenant-Colonel von Boltenstern to his presence on the afternoon of the 25th December. The Detachment was to advance on the 26th to Montoire, and, on the 27th, holding fast Montoire with some companies, to Sougé to clear up the situation at the Braye brook, and to seize hostages who should be responsible for the hostilities carried on by the population against the German patrols.

On the morning of the 26th December, at the appointed time, the Detachment stood ready in Vendôme at the exit towards Montoire. The advanced guard was formed by the 1st Squadron of the 12th Lancers under Captain von Porenbsky, the 7th and 8th Companies 79th Regiment, and a division of the 4th Light Battery Xth Army Corps, under Lieutenant Bachmann. The Fusilier Battalion 79th Regiment followed these as main body, in rear of which was the baggage, succeeded by the 5th and 6th Companies. In this order the Detachment passed through Varennes without meeting with opposition, and continued its march on Les Roches. In the immediate neighbourhood of this place the head of the advanced guard was fired upon from the cover of a wood projecting on the road, and a Lancer was mortally wounded. The squadron trotted on without halting, and drew up in front of the further border, whilst the infantry in rear searched the strip of wood. Some twenty men in blouses, without proper arms, but in part provided with cartridges, were seized and temporarily brought on. In Les Roches the bridge, which had been restored by Major von Schmidt on the 21st December, was found to be still uninjured, so that, having crossed the Loir, patrols were pushed forward in a northerly and westerly direction, and the weak 6th Company, under Lieutenant Braunbehrens, having been left behind, the march could be continued to Montoire. This place was reached at 2.30.

Lieutenant-Colonel von Boltenstern caused alarm quarters to be taken up here under cover of cantonment guards. All the exits were strongly occupied, double sentries were pushed forward several hundred paces along the roads, and in the direction of Troo and Savigny Lancer patrols were detached, who, however, saw nothing of the enemy. During the night, the infantry alone provided the patrols. In the interior of the town an Officer's guard was established in the market-place. According to the reports of the inhabitants no regular troops of the enemy were in the neighbourhood generally, and franc-tireurs would only be met with singly. The Mayors of Les Roches and Montoire gave the same information. The friendly reception which the population gave to the troops seemed remarkable. But the punishment inflicted by Körber's Detachment on the neighbouring village of St. Calais was known, and appeared in this way not to have failed to exercise a beneficial influence on their minds.

In this way passed the night without interruption; the communication with the 6th Company, which had been left in Les Roches, being maintained without difficulty.

The duty which had been confided to Lieutenant Braunbehrens of securing

the stream at Les Roches was rendered considerably more difficult from the fact that this place is hemmed in between the Loir and the rocks, which rise almost immediately out of the river. Moreover, the company which had been left behind, and to which four mounted men were attached, counted in all only fifty-six men.¹ Two double posts, which were pushed forward along the exits to the north and south of the place—a village extending some distance, and forming only a single street—could only command the view in the westerly direction by continually patrolling to the steep plateau.

The guard of twenty-two men which was posted on the bridge was also to keep up at the same time an uninterrupted patrolling on the heights, but the complete security of the place was not aimed at on account of the difficulty of the ground. The additional task assigned to the weak post to reconnoitre in the direction of Savigny could also barely be fulfilled by the four mounted men available.

In the meanwhile, about 1 p.m., the Detachment of Major Körber had entered Vendôme again from Épuisay. His patrols pushed forward in the morning on St. Calais had found this place to be again occupied by the enemy. From the remaining systematically detached patrols General von Kraatz had received no fresh reports. At St. Arnoult, alone, a patrol of Dragoons was fired at by franc-tireurs. But in order to be duly informed, under all circumstances, concerning an action which, on the 27th, might become audible somewhere in the direction of Montoire, General von Kraatz ordered for the following day the posting of an Officer on the "Temple," a ruin on the heights on the left slope of the valley south of Vendôme, which had been arranged as a place of observation.

For the 27th, Lieutenant-Colonel von Boltenstern had decided to leave two companies in Montoire, the 5th and 9th, under Captain von Dobbeler, to maintain the passage of the stream, whilst the 6th, holding fast to Les Roches, was to obtain supplies from Lunay; with the remaining five companies, a squadron and two guns he intended to continue his advance towards the Braye district. Körber's Detachment was assumed to be still in the neighbourhood of St. Calais.

At 8 o'clock the advance from Montoire commenced. The advanced guard, under Captain Herzbruch, consisted of the Lancers and the 7th and 8th Companies; the main body followed with the 10th Company at the head, succeeded by the guns and ammunition wagons, then the 11th and 12th Companies, and behind them two wagons each of the sanitary detachment, small-arm ammunition, and ambulance.

The road from Montoire to Pont de Braye runs on the right bank of the Loir at the foot of steep heights, distant at first some 2,000 paces from the stream. Only a few narrow rocky paths lead to the ridge, the view over which is often restricted and which is covered with patches of wood and hedges. In the valley also movement to the side of the road was much hindered by extensive water meadows and numerous wet ditches. Near Troo the edge of the heights abutted immediately upon the stream, so that a narrow and easily defensible defile is formed here, behind which the valley once more widens out. The Loir itself was at this time covered with thin ice, which, however, did not bear, and all the crossings below Montoire were so completely destroyed by the French, that a restoration of these within a short time without previously prepared materials was not to be thought of. Any attack on the right flank of the advancing detachment would threaten to hem it in against the stream, whilst, on the other hand, its left flank was covered by the latter against any hostile enterprise.

The security of the right flank was to be provided for by sending off cavalry patrols at daybreak, which were to open up connection with the

¹ A great part of the company was still absent on prisoners' escort.

Detachment of Major Körber—still assumed to be on the road St. Calais—Vendôme. In consideration of the difficulties of the country these patrols were authorized not to return, in case they should meet with the other Detachment.

For the rest, the observation of the ground on this side during the march was to be limited to accompanying the column with the ordinary flank patrols.

Towards 10 o'clock Troo was reached, and from its houses, which are for the most part excavated from the rocks like caves, the advanced guard was frequently fired upon. Lieutenant-Colonel von Boltenstern ordered a thorough search of the place, which was known to be a main hiding-place of the swarms of franc-tireurs. All grown men were to be driven together, and brought on as hostages. The peculiar construction of the place, however, increased the difficulty of this task to such an extent that the commander of the Detachment, after a delay of nearly two hours, was compelled to decide to leave the 7th and 10th Companies behind, so as to continue his march to the Braye Brook with the small remaining force.

On the far side of Troo several deserted bivouacs were found close to the road, so that, in fact, as the inhabitants maintained, the mass of the swarms which had been traced here appeared to have retired in a westerly direction. But when the Lancers, under Lieutenant von Kurowski, at the head of the advanced guard, had reached Sougé, they came upon several earthen ramparts¹ from which, on their near approach, they were fired upon. Simultaneously hostile columns, apparently three battalions, appeared in sight, advancing from Pont de Braye, whilst from the earthworks near Sougé swarms of skirmishers deployed against this place. In the meantime the 8th Company had penetrated into Sougé. The advanced party, after it had moved several hundred paces along the village street, was suddenly fired into from the surrounding houses. After that the leader, Lieutenant Crome, had been mortally wounded, the subdivision retired again from the village. Nevertheless, Lieutenant Buhlers succeeded in forcing his way into the village again with an ambulance and some men, and rescuing the dying Officer from the enemy's hands. Lieutenant Bachmann, who had brought his two guns into action south of the road, now opened fire on the earth ramparts at a range of about 2,500 paces, and with such satisfactory results that the enemy there broke up and fled, partly to the north-west, partly to the village in front of them. In the meantime the 11th Company was extended on both sides of the road to receive the 8th Company, which had been recalled, and also to cover the guns.

Lieutenant-Colonel von Boltenstern recognized by this time that superior forces were in front of him. As the enemy, moreover, showed a desire to advance along the edge of the heights, so as to threaten the line of retreat of the Detachment, and a further delay appeared to be purposeless, he resolved to break off the action. As soon as the 8th Company had come up, the guns limbered up and followed the main body which was already retreating on Troo. The enemy pressed on with skirmishers forthwith from Sougé, into which place also, after it had been evacuated by the 8th Company, several shells had been sent. One of the guns was, therefore, obliged to unlimber repeatedly on the road, so as by well-directed shells to keep the enemy at a respectful distance.

Meanwhile patrols of the squadron, which was now marching with the main body, again attempted to climb the ridge; they observed there small hostile detachments of infantry, which, however, did not further molest the retreat. The rear-guard also was fired upon near Troo by armed peasants from the south bank of the Loir, but suffered no loss.

¹ There are here remains of an old Roman camp—the so-called "Cæsar's camp."

In Troo the searching of the labyrinth of caves, in which numerous arms, especially Chassepôts, were discovered, was not yet ended. A short halt again to be made. Here also a suspicious movement amongst the population was already observed, and moreover a single hostile horseman had been remarked. In spite of this the situation appeared to be in nowise dangerous, and still less so when Troo had already been left and the Detachment was in the act of marching on St. Quentin with the hostages which had been collected, some seventy in number. Then suddenly a cannon shot resounded from the ground north of Montoire.

General de Jouffroy, on the evening of the 26th, after his arrival in Bessé-sur-Braye, had at first been in doubt whether he should move on St. Calais or turn towards the Loir, but had then learnt from the Mayor of Les Roches of the presence of Boltensern's Detachment in Montoire and Les Roches. He resolved, therefore, immediately to throw himself with all his forces on this hostile column, and moved off first towards Fontaine at earliest dawn on the 27th December.

His intelligence was accurate enough; the German detachment was reported to number 1,500 men, infantry and cavalry, and four guns. The French General had at his disposal from 8,000 to 10,000 men, three batteries and two mitrailleuses. In Fontaine he learned the later intelligence concerning the measures which had been taken by Lieutenant-Colonel von Boltensern during the morning of the 27th. In Les Roches only 100 men, in Montoire only about 300, had remained, all the rest had marched on Troo. Only in reference to the passages of the Loir was the General falsely informed, since he fully believed that the bridge at Montoire, which the French had destroyed, had not yet been restored. So he resolved to obtain possession of the crossing at Les Roches, to occupy the road Montoire—Savigny, on a line with St. Quentin, and with the remainder of his troops to attack his opponent about Troo, so as to throw him back into the triangle St. Quentin—Les Roches—Montoire, and thus to compel him to surrender. In the town-hall of Fontaine General de Jouffroy acquainted his Officers with the general situation and gave out his last dispositions. No one doubted of success; "Nous les tenons cette fois" resounded soon through the French ranks.

A battalion of the 45th Régiment de Marche, the Éclaireurs of Gironde,¹ with a battery, was to attack Les Roches, the Chasseur Bataillon de Marche was to occupy Fosse, and the two other battalions of the 45th Régiment de Marche were to post themselves upon the road Savigny—Montoire on a line with St. Quentin. A reserve, formed of parts of the 2nd Brigade, was directed to remain at the commander's disposal between Fontaine and St. Quentin, whilst the remaining part of the division was to advance on Troo. It appears that the attack was directed later with three battalions and a battery against Troo, with five battalions,² a battery, and the mitrailleuses against Montoire, and with one battalion and a battery against Les Roches, whilst the cavalry reconnoitred towards Vendôme. The main column, that of the centre, had evidently divided itself in the course of the battle, as Montoire was only weakly attacked, whilst the main forces under General de Jouffroy's own leading appear, on the other hand, to have posted themselves east of St. Quentin directly across the road, and extending as far as the Loir.

Slowly as the movements of the French were carried out, the delay which had been caused to Lieutenant-Colonel von Boltensern in Troo, and before Sougé,³ secured for them time enough completely to bar the line of retreat of

¹ The ordre de bataille does not make any mention of these éclaireurs.

² Including the reserve.

³ Here apparently they were in the neighbourhood of troops of General Barry (16th Corps).

the Germans, and they had succeeded in this, without the Lancer patrols, which had advanced in a northerly direction, and had been partly dispersed, bringing any intelligence to the Detachment concerning the French advance.

When Lieutenant-Colonel von Boltenstern heard the first artillery shots on his flank, he at first still believed that he only had to do with an action in which Körber's Detachment, which was supposed to be in that neighbourhood, was involved. By a rapid march he intended to hasten to its assistance. But soon the Lancers reconnoitring on that side reported that hostile infantry was visible on the heights north of Montoire; it was clear that the artillery fire was directed against his own Detachment. Near Ferme l'Arche Captain von Porembsky, marching at the head of the column, found himself suddenly in face of a hostile line of skirmishers, which held the space between the heights and the Loir. A division under Lieutenant Kirchner rode against this line, but was repulsed with loss. Again when the infantry reached the easternmost buildings of St. Quentin, the enemy's shells greeted them. There was now no room for doubt that they were surrounded, and had lost their line of retreat.

Lieutenant-Colonel von Boltenstern brought his two guns at once to the front, and they unlimbered between the easternmost building of St. Quentin and Ferme l'Arche on the road towards the left flank. They were received with a hot fire from all sides. In spite of the superiority of the French artillery, Lieutenant Bachmann directed his attention solely upon the opposing infantry some 1,100 paces in front of him. In the meanwhile the German infantry also had deployed on the threatened flank. The 10th Company was brought forward at a run to occupy the unimportant buildings of the Ferme l'Arche, near it on the right the 8th deployed a line of skirmishers in the ditches of the road, and occupied with the remainder a house standing alone. On both sides of the guns the 12th Company lined the ditches of the road, the 11th occupied a building on the extreme left flank with an adjoining stable and a ditch running from here to the heights west of Chalay Château. The 7th Company sought with the baggage a covered position in St. Quentin, where also the squadron found some protection against the enemy's fire.

The hostages which had been collected had hitherto been retained behind the 12th Company. They now believed that the moment of their deliverance had arrived. A large number of them broke away and endeavoured to escape by the rear. But the 7th Company, which had been retained in the rear, immediately deployed some of its men, and opened fire upon the fugitives, so that about thirty of these were killed or wounded, and only two succeeded in reaching the cover of a copse, whilst the remaining forty were secured and were obliged to seek cover in the ditches of the road against the fire of their countrymen.

The white clouds of smoke alone showed the lines of the enemy who was covered in deep ditches, and with his long-ranging weapons swept the ground in front and on the flanks, without being within reach of the fire of the German infantry. Lieutenant-Colonel von Boltenstern therefore advanced the 10th and 12th Companies a few hundred paces, where they took post in a ditch running from the heights to the road, so that their left flank extended half way to the heights. A hot musketry engagement soon developed here, during which columns could be seen in rear of the enemy's fighting line descending from the heights in the direction of the road. At the bend of the road to Montoire four detachments in close formation were visible. Behind the enemy's fighting line a battery had unlimbered, and had pushed forward two guns close up to a house standing by itself. After a short engagement these were put out of action by Lieutenant Bachmann, and

could only be moved to the rear with difficulty. But now a second line was seen deployed behind the first line of skirmishers, stronger than it and extending to the Loir.

In this way the action continued for about three-quarters of an hour, when suddenly the Detachment was fired upon by a battery which had driven up to the north-west of St. Quentin. The 7th Company therefore occupied the buildings situated there, and pushed its skirmishing division about 100 paces forward to a cutting. The shells of the newly arrived battery were directed for the most part against the squadron and the wagons parked in the village, the latter of which were almost completely destroyed. Captain von Porembsky, therefore, endeavoured to break through in a northerly direction, so as to reach the road Epuisay—Vendôme. The squadron succeeded in ascending the heights, but was here met by shell-fire, and a French battalion in close order barred the road. It was therefore obliged to return to St. Quentin, and to seek cover behind the wall of the churchyard.

Lieutenant Bachmann's guns also were in a serious plight. A gun commander, six men, and the hospital assistant had already been put out of action, six horses had been killed and two wounded. As the limber ammunition was already expended, shells had to be brought up singly from the ammunition wagons. Moreover a shell from the enemy struck one of the limbers, fortunately without exploding. After Lieutenant Bachmann had for a moment increased his fire to the utmost, the guns were withdrawn in order to be put into condition for further movements.

Lieutenant-Colonel von Boltensstern, who for long had recognized the desperate nature of his position, was convinced that further delay could now bring nothing but disadvantage. The bayonet must here open a way of escape! The preparations for a general forward movement were accordingly soon made. Four companies, counting from the right flank, the 8th, 10th, 12th, and 11th, were to throw themselves in a north-easterly direction in dispersed order upon the enemy, in order to force him back towards the heights, the 7th Company in close order with both the colours was to dash forward along the road, and the squadron as well as the guns were to follow as rapidly as possible on Montoire, as soon as the infantry had succeeded in breaking through the enemy's position at any point.

In this state of affairs the most complete coolness was necessary. In view of the possibility of their not succeeding in breaking through the enemy's lines, a fire was lighted by the 11th Company, so that the colours might be given up to the flames, rather than that they should be allowed to fall into the enemy's hands.

The 11th and 8th Companies first advanced into line with the 10th and 12th; then Lieutenant-Colonel von Boltensstern, by way of order to attack, gave the signal "The whole will advance."

Their Officers in front, the companies, now marching, now at a run, rushed with continued hurrahs across the intersected ground between the main road and the heights upon the enemy.

Almost without loss the first line was reached and broken through; scarcely did the enemy succeed in saving the guns which had driven up behind it; an ammunition wagon was captured. After a short halt the Germans rushed forward once more against the second French line. Here also the enemy's fire was hurried and consequently little effective, but this time he made a better stand, so that at several points an obstinate hand-to-hand encounter ensued. Then the deciding stroke fell on the right wing. The 7th Company had originally followed along the road in close order. The enemy had occupied the buildings of a mill on the Loir, and thence swept the road with full effect. The company leader, 1st Lieutenant von Hirschfeld, leaving the skirmishing division alone with the colours upon the road, bent away himself with the two other divisions to the Loir. In a short time the

buildings of the mill were captured, 1st Lieutenant von Hirschfeld, with Ensign von Reden and Vice-Sergeant-Major Gross were the first to force their way in. Six of the enemy's Officers, including a Staff Officer, were captured; in wild flight the opponents rushed across the road to the heights.

In the meantime the squadron and the artillery division had followed the 7th Company. They were ordered to reach Montoire at all hazards. Like the 7th Company, Captain von Poremsky bent away also from the road in a southerly direction, broke through the enemy's shooting line, and after riding past their supports which kept up a continuous fire, came upon broad ditches which compelled the squadron to dismount. Then once more they galloped through the hostile swarms, but these already were throwing away their arms, to seek shelter in the ditches from the fire of their own artillery. Speeding along close by the riverside the squadron at length reached Montoire. What had been left behind in its bold ride was afterwards saved from the hands of the enemy by the infantry following.

Lieutenant Bachmann had not left the road with his guns. Commencing at a trot, after breaking through the first line of the enemy's infantry, he had hastened onwards at an ever-increasing pace under the fire of the fugitives lying on both sides of the road. The second French skirmishing line was first visible when he had approached to within 200 paces. But now the near leader of the first gun fell dead with his driver, who was wounded. The second gun, the ammunition wagon, and a medicine cart without a driver trotted onward. Lieutenant Bachmann remained with the first gun, and had the leader disengaged, and the off leader unhooked. Then he hastened after the other gun. In the midst of the enemy's skirmishers the near wheel horse of the second gun fell. The Officer ordered the first gun and the ammunition wagon to hasten to Montoire at a gallop, whilst he himself, surrounded by the French at from 30 to 40 paces distance, endeavoured to get the second gun also into trim again. The dead horse lay directly before the limber wheels, and only three men were available to drag it aside. In wild haste the flying masses of the enemy rushed now from the mill past the gun. At length this also, though with only two horses yoked, was again ready to move off, and likewise succeeded in reaching Montoire at its best pace.

Being the first of all to arrive here, Lieutenant Bachmann halted in the market place in order to get the frozen bolts into workable order by greasing them. The teams also of both guns were brought up to four by harnessing riding horses.

In the meantime the enemy's second line also had been rolled up from the left flank, and thrown back into the hills. Two battalions in close order in the centre had, indeed, endeavoured to give a favourable turn to the action by advancing with skirmishers in front from the ground north of Fosse against the chaussée. They met with intermingled parts of the 8th, 10th, and 12th Companies, and compelled them to give way for a moment. Soon, however, the men of the 79th Regiment threw themselves once more upon the enemy; the latter did not await the onset, but now broke up and streamed backward. On the left flank the 11th Company, taking as objective a house standing by itself, had pressed forward, in spite of a hot flanking fire from ditches, hedges and copses, as far as the foot of the heights, and afterwards to the crest from whence it sent a rapid file-fire upon the enemy who was falling back upon Fontaine; twenty to twenty-five unwounded prisoners also fell into their hands. General de Jouffroy himself appears to have been in danger of being taken prisoner here. According to the report of a prisoner he had been surprised by the sudden advance of the Prussians, and had not been able to withdraw from the French fighting line. He had, therefore, remained concealed with his staff in a small house situated on the slope, which the attacking troops passed close by.

In the attack of the second line,¹ Major von Steinäcker, hastening on in front of all, was slightly wounded in the neck, Lieutenant Buhlers severely in the leg; 1st Lieutenant Niemeyer in the hand-to-hand encounter, from which two men freed him, received a thrust in the arm,² Vice-Sergeant-Major Ihssen fell severely wounded by two bullets. The behaviour of all was beyond praise.

Whilst the enemy fled, partly on Les Roches, partly on Fontaine, the 79th turned to Montoire. To facilitate the reassembling, as well as to indicate the direction, Major von Steinäcker made a bugler sound the call "Fusilier Battalion, half-right" for about twenty minutes. After that the companies which had advanced furthest in a northerly direction—the 11th and 12th—were in some measure collected, they also marched off, covered by a rear-guard, to Montoire. About 1,500 paces from the north-west entrance they reached the main road, on which companies of the enemy were already following them again. Lieutenant von Witowsky, who had remained somewhat in rear, was here taken prisoner.

It was past 4 o'clock, and was already beginning to grow dark, when the brave five companies were got into order in the market-place of Montoire, bringing with them as prisoners 10 Officers and more than 200 men of the enemy, as well as the hostages.³ About 4.30 Lieutenant-Colonel von Boltensern had assembled his entire Detachment, excepting the 6th Company, left in Montoire.⁴ The baggage alone was for the most part lost.

On Montoire also, during the course of the day, several attacks, though not of a serious nature, had been made. Captain von Dobbeler, after Lieutenant-Colonel von Boltensern had marched off, had had guards from the 9th Company posted at the exits of the suburbs Prazé and Patis, as well as on the bridge over the Loir. The 5th Company pushed a division to the north-east boundary of the town, and the remaining part of the Detachment took up a position in the market-place, the baggage-wagons being horsed.

About 1 o'clock a patrol from Vendôme came in with an order from General von Kraatz for Lieutenant-Colonel von Boltensern. Being sent on to Troo, it turned back after about fifteen minutes, as strong hostile forces had been seen in front of St. Quentin. Shortly afterwards the breaking out of the action there was audible in Montoire. When the patrol again was directed to ride back with the report to Vendôme by Les Roches, this road was also found to be threatened by hostile detachments, visible on the heights of Les

¹ Lieutenant-Colonel von Boltensern writes in reference to this:—"I myself was some eight or ten paces from Major von Steinäcker when I saw him suddenly turn and fall; a bugler and a drummer sprang forward to assist him, but half-raising himself, he threw or pushed them both from him with the words:—"Lads, let me alone, take care of yourselves!" Then he asked me whether he was bleeding much, and when I replied that he seemed to me to be not severely wounded, he quickly wrapped his pocket handkerchief on the bleeding place, and then ran back to the fighting line.

² The Officer and his opponent had fallen, and he was already lying under the Frenchman, when musketeer Voges and fusilier Friedrichs sprang to his help and bayoneted the latter.

³ The Staff Officer captured in the mill had refused to move on with the attack, on the ground that it was against the custom of war to lead prisoners against the enemy. Lieutenant-Colonel von Boltensern answered that it was no matter on this occasion, and compelled him and his comrades to advance. The bearing of the German troops had not failed to impress the captives. The Staff Officer exclaimed repeatedly during the retreat—"Oh, what a scandal for the French Army; two battalions against 8,000 men!" When asked why he surrendered himself so quickly, he replied to Lieutenant-Colonel von Boltensern—"Colonel, il est impossible de résister à un tel hourra!"

⁴ Montoire is clearly a misprint for Les Roches.—Tr.

Roches. At the same time the post at the exit of the suburb Prazé reported that several columns, consisting of infantry and artillery, were visible, marching along the heights situated to the north, in an easterly direction.¹

Captain von Dobbeler hereupon took his measures for the defence of Montoire. He sent the two divisions of the 5th Company, which were with the main body, as a reinforcement to the exit towards Les Roches, and occupied the suburb Prazé with the 9th Company. At both places small bodies of the enemy's cavalry first moved forward against the town, then a battery drove up near Le Tertre and threw several shells over it; infantry, also in the strength of two companies, now came up between the roads to Savigny and Les Roches to within about 600 metres, and opened a lively but ineffective fire. A third company pushed forward at the same time along the road from Savigny, but gave way before a division of the 9th Company, which advanced against its flank from the suburb of Prazé. The enemy had stopped his artillery fire again after a short time, and soon drew off his infantry also in the direction of Les Roches. All these attacks were made without energy, and were completely discontinued after Lieutenant-Colonel von Boltenstern had commenced to break through the enemy's lines.

With the closing-in of darkness snow showers had come on, which rendered invisible all distant objects. When the 11th and 12th Companies, closely followed by the enemy, had reached the entrance to the suburb Prazé, Major von Steinäcker left his Adjutant, Lieutenant von Heimbürg, with the division of the 9th Company which was posted here.

This Officer was just in the act of getting the division into order when close before him appeared a hostile detachment, which was at first taken for friends. The French Commander called upon the division to surrender, and at the same time challenged Lieutenant von Heimbürg to single combat. The latter answered the request with a volley, followed by file-fire. The enemy fell into confusion, and by this means the main body of the Detachment gained time to carry out, without further fighting, the evacuation of Montoire, which had been already determined on.

Lieutenant-Colonel von Boltenstern was forced to the conviction that he was opposed by a greatly superior force of the enemy. Lancers pushed forwards towards Les Roches, and on the road St. Arnoult—Vendôme, reported that the latter road was clear, but in the direction of the former place, a few hundred yards from Montoire, hostile detachments were already visible. As a consequence of this the crossing at Les Roches was already presumably lost, and the commander of the Detachment decided therefore upon retreating across the Loir without delay, in spite of the fatigue of his troops, so that the enemy should not be able to bar his road again, by anticipating him from Les Roches on Ambloy.

Captain von Dobbeler, with the 5th and 9th Companies, was to take over the rear-guard, the remaining fusilier companies to form the advance, followed by the prisoners, hostages, and artillery; behind these the 7th and 8th Companies, the Lancers,² and all that was remaining of the baggage.³ The inhabitants of the town of Montoire, irritated at the carrying off of the prisoners, were only kept by serious measures from violence.

Without further losses the main body of the Detachment marched out of Montoire, and took the road to Lavardin. Lieutenant-Colonel von Boltenstern remained personally on the bridge till the last baggage-wagon had crossed.

¹ The detachment sent by General de Jouffroy against Les Roches had, in fact, been misled by a guide, and was now for the first time marching against that place by a circuitous road close past Montoire.

² Later on the cavalry was moved to the head of the column.

³ Supply wagons which, during the advance on Sougé, had been left behind in Montoire with Captain von Dobbeler.

He then moved to the front to seek out the homeward road, in which he was greatly assisted by Lieutenant Fleischer, who had been with Major Schmidt von Knobelsdorf in Montoire on the 22nd December. After marching for an hour and a half a report came in that the baggage had remained behind, and that of the rear-guard also nothing more was to be seen. This report was brought by the train soldier of the 11th Company, who, running after the main body, reached it breathless, and said that, directly after moving off, the second baggage-wagon had broken its shafts, so that the column remained fast in a narrow cutting. In the meantime the French had pressed on into Montoire, and had captured the baggage and most of the drivers.

Lieutenant-Colonel von Boltensstern received no reports concerning the fate of his rear-guard. As, however, no action had been audible in rear, there was some ground for being at ease concerning its fate, whilst, on account of the over-fatigue of the men and the danger of the general situation, the turning back of the main body could not well be thought of. Therefore the march was continued without delay, the Detachment being still frequently fired at in the villages by peasants. About 11 o'clock p.m. they succeeded in reaching Vendôme, after the men, who were completely worn out, had, most of them, marched this day about 31 miles and taken part in a severe action.

Two hours later came in the rear-guard, also without loss. When it left Montoire, through the excited populace of which it had to force its way with levelled rifles, French troops had also already penetrated along the Loir into the town. In spite of this, Captain von Dobbeler found the bridge momentarily clear of the enemy and crossed the river without fighting. He succeeded, moving close past the enemy's columns, in gaining a start of 300 to 400 paces in the direction of St. Arnoult. On the freshly fallen snow it could now be seen that the main body had hit off another road; notwithstanding, Captain von Dobbeler resolved to continue on the road he had taken, as the enemy had again strongly occupied St. Oustrille, and so barred the way to Lavardin. He marched, therefore, to St. Arnoult, and from here, under the guidance of an inhabitant, by Prunay, Ambloy, and Huisseau-en-Beauce to Vendôme, where he safely arrived on the 28th December at 1 A.M.

Concerning the fate of his 6th Company Lieutenant-Colonel von Boltensstern first received information at Vendôme.

Lieutenant von Braunbehrens had received the report of the march of the Detachment on Sougé about 10 A.M., and with it an order was repeated to reconnoitre on Savigny, and to requisition oats and beef cattle in the localities situated on the heights. He detached, therefore, Lieutenant Wahnschaffe, about 11 o'clock, with 1 non-commissioned officer, 10 men, and 2 Lancers, to Lunay, so that he had left in Les Roches only 45 men and 2 Lancers, of which 1 non-commissioned officer and 22 men were posted as a picquet at the bridge over the Loir, whilst the remainder took up alarm quarters in the interior of the village. Between two and three in the afternoon the post at the exit towards Montoire reported that artillery fire was audible from that place. Immediately a patrol was sent on to the heights west of the village, but as soon as it arrived here it was met with fire from hostile skirmishers.

The detachment sent off by General de Jouffroy on Les Roches appeared now for the first time before this place, after that it had moved past Montoire, as related, and had temporarily taken part in the attack upon that town. Now also the fire of the double post stationed at the southern exit from the place sufficed to bar the entry from this side to the French.

As the hostile skirmishers deployed on the heights swept with their fire the village street and the bridge over the Loir, Lieutenant Braunbehrens decided to retire to the left bank. From the peculiar form of the village it resulted that an assistant-surgeon and 13 men, who were not able to get across the river quickly enough, fell into the hands of the enemy, who unexpectedly penetrated into the place. As the latter then shortly crossed the stream at a

mill-dam below the village, Lieutenant Braunbehrens had to evacuate his new position also and to retire along the Loir. In Varennes an order from General von Kraatz reached him, according to which he was to put out outposts towards Les Roches.

Lieutenant Wahnschaffe, who had been detached to Lunay, and whose departure had been delayed by difficulties which the Mayor of Les Roches had put in his way concerning the horsing of the necessary wagons, was occupied there with the execution of his task, when hostile horsemen, whose vicinity had been hitherto unknown, penetrated into the village and captured the weak party, in spite of stubborn resistance.¹

The consternation which took possession of the troops of General de Joffroy, who had only been engaged in front of Les Roches, when they heard from fugitives of the events recently enacted at St. Quentin, is remarkable evidence of the great impression made upon the enemy by the bold charge of Lieutenant-Colonel von Boltensstern and his brave troops. They imagined themselves cut off, and sought in Les Roches for guides acquainted with the country, so as, if possible, to be able to escape by a circuitous route to Bessé-sur-Braye. Their minds were only set at rest when the General Staff Officer of the Division arrived in the night with the report of a pretended great victory of Montoire. General Chanzy likewise lauds in his book the action of St. Quentin as an important victory of the French. Somewhat different runs the report of an eye-witness. The latter admits that the enemy was believed to be safely caught in a trap, but he says, "we were far from this result; the battle-field remained in our hands, but the enemy had escaped us."²

General de Joffroy assembled his troops at Montoire.

The Detachment of Lieutenant-Colonel von Boltensstern suffered in its expedition a total loss of about 150 men and 50 horses,³ but it had inflicted on the enemy a loss in killed and wounded at any rate very much greater, had made prisoners 10 Officers and above 230 men, and had moreover brought away 40 hostages. In truth it was a brilliant feat against a surrounding force eight times as numerous.

It remains still to follow out the events which took place in Vendôme in the course of 27th December.

About 1.15 P.M. the outposts and the Officer stationed at the observing post on a height south of the town reported that they heard some artillery fire in the direction of Montoire.⁴ Then when, after 2 o'clock, a stronger artillery

¹ The circumstance in detail was as follows:—When Lieutenant Wahnschaffe had arrived before Lunay, in a thick mist and a fall of fine snow, he caused the village to be examined by two patrols, and then charged the non-commissioned officer with the carrying out of the requisition, and betook himself with three men to the heights on the north of the village running towards Savigny, and upon them he posted the men as a standing patrol, whilst he himself returned again to the market-place. As the behaviour of the inhabitants appeared to be suspicious the requisition was hurried on, and then the march to Les Roches was commenced. At the head marched a Lancer; the standing patrol from the heights returned and followed as rear-guard. A delay in the village arose by the breaking loose of some cows. During this the leader of the detachment suddenly saw the moving cloaks of some Chasseurs à Cheval. Upon his command, "About! Fire!" a volley followed simultaneously from the opposing cavalry, by which two men were wounded. Lieutenant Wahnschaffe shouted to his men—"Out of the village, to the heights!" The order could, however, no longer be carried out, for already the leading Lancer came back followed by several hostile horsemen, and cavalry also was visible in the adjoining streets. In the attempt to gain the open through a garden the leader of the small party was captured, upon which the men met with the same fate.

² "Spectateur Militaire," Tome 29 (October—December, 1872), page 111.

³ Appendix II contains the detailed list of casualties.

⁴ The regularly detached patrol from the 12th Lancers, which left for Épuisay

fire became audible in Vendôme, General von Kraatz betook himself to the high ground before-mentioned, where the post of observation was erected, so as from there to follow the direction of the fire. At the same time he sent a patrol of Dragoons forward at a trot on the main road by Varennes with the commission to receive Lieutenant-Colonel von Boltenstern's report, which would probably meet them, and to bring it back with all despatch, but in any case to obtain intelligence of the column as soon as possible. As after the lapse of half-an-hour the artillery fire still continued, a particularly well-mounted non-commissioned officer, who hoped, by going alone, to be able to bring intelligence in the shortest time, was sent after the patrol with the same object. At the same time General von Kraatz caused a division of Lancers, under Lieutenant von Bonin, to advance upon Savigny by Fortan, in order to gain certain intelligence as to whether hostile forces had advanced into the space between the Loir and the main road—Vendôme—St. Calais—Le Mans.¹

From the battlefield, about 4 o'clock, the first information came in. Lieutenant Braunbehrens reported upon the advance at Les Roches, and added that he had lost touch with Montoire. The order already mentioned—to remain in the position of Varennes and to put out temporary outposts there—was immediately sent to him. At the same time it was ordered that two companies of the 56th Regiment should move off to the same point in order to take up there an outpost position for the night. After 4 o'clock the artillery fire at Montoire ceased. When the General had returned to Vendôme after the setting in of darkness, a question by telegraph as to the state of affairs came in at 5.30 P.M., from the Corps Commander, to whom General von Diringshofen had reported that artillery and small-arm fire was audible from the direction of St. Arnoult. A detachment of 2 battalions, 1½ squadrons, a light battery and some pioneers under Colonel von Ehrenberg had advanced from Herbault to Château Renault, on the 27th December, had occupied this place, had foraged in Villedomer and Auzouer, and had blown up the viaduct at Villedomer. The noise of the action at Montoire had been heard by this detachment as well as also in Herbault itself. Of the patrols pushed forward upon La Ferrière and St. Arnoult, the former had not come upon any enemy, on the other hand, the latter, which had advanced as far as Montoire, came upon the head of von Boltenstern's Detachment as it was marching back. Colonel von Ehrenberg took up alarm quarters in Château Renault in the evening.

General von Kraatz reported at once to Blois concerning the errand of von Boltenstern's Detachment, but with regard to its execution, he was not able as yet to give any information. He, however, communicated the occurrences at Les Roches as well as his intention to push forward, on the 28th, stronger detachments on both banks of the Loir. By carefully noting that the single cannon shots between 1 and 2 o'clock were only slightly audible, but that the hotter artillery fire between 2 and 4 o'clock was much more perceptible, and was exactly in the direction of Montoire and always in the same strength, the General had come to the conclusion that von Boltenstern's column had come upon superior hostile forces on the far side of Montoire, which were probably acting with the object of seizing this point situated on the flank of Vendôme. Lieutenant-Colonel von Boltenstern must have retired

at about 7.30 A.M., and had its heads towards Mondoubleau, St. Calais and Savigny, had found no trace of the enemy. The report was received at the Divisional Headquarters after the return of the patrol, which took place about 6 P.M.

¹ After a ride of over 38 miles this patrol returned about 10.30 P.M. It brought the report, certainly only partially correct, that the enemy had moved from St. Calais on Bessé and Troo, that Lunay and even Villiers were already occupied, and that strong cavalry patrols of the enemy had advanced from Lunay *via* Fortan on Épuisay.

to Montoire with the intention of accepting battle for the possession of that place, an assumption which Lieutenant Braunbehren's report appeared to confirm. The General reasoned further, that, as the battle on the 27th had continued till darkness came on, it would probably be renewed on the 28th for the possession of Montoire and Les Roches, and therefore detachments for both these points must be got into readiness. In order to increase the certainty of the success, he telegraphed at 6.40 to General von Voigts-Rhetz, asking that the detachment in Château Renault should be ordered to move on Montoire, and, if possible, in such a way that it should be able to reach that point at daybreak. It was added that the bridge of Montoire had been restored and that Lieutenant-Colonel von Boltenstern had probably come upon strong hostile forces at Troo or Sougé.

From the reply of General von Voigts-Rhetz it was evident that the latter regarded the situation as still more serious. It seemed to him doubtful whether the desired assistance could be given from Château Renault, at any rate at the hour mentioned. General von Diringshofen was, however, ordered to afford all possible support. But assistance could be obtained in the quickest and most effective way from Vendôme alone.

For the 28th General von Kraatz had, in the meanwhile, already ordered that the 1st Battalion 79th Regiment should be pushed forward on the right bank of the Loir, and two companies of the 56th Regiment on the left bank, to obtain intelligence concerning the position of Boltenstern's Detachment. It was also determined that, for the future, in addition to the patrols hitherto sent out, one should advance on the direct road Fortan—St. Calais, and should push its head as far as the neighbourhood of St. Calais. Till late in the evening news of the Detachment was awaited.¹ Then about 10 o'clock the first verbal report of Lieutenant-Colonel von Boltenstern concerning the danger they had gone through, as well as their forthcoming return, was brought in by Lieutenant Totenhöfer of the Lancer Regiment. At 10 o'clock this report was forwarded by telegraph to Blois.

H.R.H. Prince Frederick Charles did honour to the heroic behaviour of the Detachment by bringing it to the notice of the whole Army at the head of the order of the day of 31st December.

The expedition here described is a further proof that courage and resolution have almost ever availed to deliver a soldier from the most serious situations. And even if the bold resolution had not been rewarded with success on this occasion, still it is always better to fall with honour than to be fearful of resorting to the most extreme measures.

Dangerous situations, like that of Boltenstern's Detachment, will naturally be continually recurring in minor warfare, and especially in the case of the raids of flying columns. But the great advantages which a skilful strategy is able to draw from the action of such columns outweigh almost entirely the risks thereby incurred. In this case the heroic fight of Boltenstern's Detachment brought to General von Kraatz as its result a clearing up of the suddenly changed strategical situation. The latter knew now that the opponent who ten days ago had retreated upon Le Mans in apparently complete dispersion was beginning to bestir himself afresh. The action of Montoire formed, in fact, the introduction to the battles which took place around Vendôme at the close of the year. Hitherto, also, these detached columns had effected

¹ The patrols detached by General von Kraatz towards Montoire had first, when riding to Les Roches, come upon Lieutenant Braunbehrens with the remaining men of his party, had been turned back there, and had strayed in the darkness into the broken ground between Villavard and Houssay; finally, they had found Boltenstern's column on their return march; not, however, till the report of the commander had already been sent off to Vendôme.

what mere patrols could in no wise have accomplished ; the circle of observation in the direction of the enemy was cleared to a distance of two days' march, the enterprises of the inhabitants were kept down, and the supply of the troops remaining on the Loir was secured to the fullest extent. Certainly the task of these columns was as a rule a difficult one. The limited number of troops available at Vendôme rendered it always necessary that isolated columns should be sent into the country in front. Under such circumstances it was no doubt advantageous that the broken nature of the ground and the impossibility of seeing over it favoured undertakings of this nature ; but, on the other hand, the columns which advanced directly along the Loir valley itself, in spite of the security to their flank afforded by the river, found themselves, in consequence of the limitation of their movements resulting from it, at a considerable disadvantage with the more independent enemy operating upon the heights. Only a wide reconnaissance could remedy this, and a reconnaissance especially in the direction of the flanks. It follows from this that it is essential for flying columns to be as liberally provided with cavalry as is possible, and that for isolated advancing columns it is plainly more important to push this arm out far to the flanks than to the front. In the case under consideration, the commander of the Detachment was influenced by the circumstance that the squadron attached to him numbered only some seventy sabres, and on the morning of the 27th, after deducting the necessary detachments in Les Roches and Montoire, only fifty-four ; but above all, it was to be regretted that the squadron was pushed forward in the valley as advanced guard, instead of covering the flank on the heights with patrols pushed out far to the north and north-west.

A considerably more extensive system of patrols from Vendôme would not have provided the necessary security, even if their regularity—due to the long distances to be covered—had been lessened by making the detached cavalry parties pass the night at some point outside of the limit of security, instead of returning on the same day ; a measure which was frequently adopted by our cavalry in the wars of liberation also in winter time.

The expedition here related shows further that, by holding fast to Les Roches, no advantage resulted to the Detachment ; but, on the other hand, from the maintenance of Montoire a great advantage was gained, the importance of which was proved. If Montoire, like Les Roches, had been lost, the fate of the Detachment pushed forward on Sougé could hardly have been averted. In similar situations it would therefore appear judicious for numerically weak columns to occupy only the most important of the defiles in rear, but to occupy this in sufficient force. From the resolves of General von Kraatz, as his report to General von Voigts-Rhetz makes clear, it was evident, after the loss of Les Roches was known, that in consequence of his information he assumed the crossing of Montoire to be in the hand of Boltenstern's Detachment, which assumption, in fact, proved to be correct. In any other condition of affairs the arrival, about 4 p.m., of the report of the loss of Les Roches would most likely have called for the immediate carrying out of the measures projected for the support of Boltenstern's Detachment on the morrow, in spite of the advanced hour of the day, of the cessation of firing which soon ensued, and of the urgent need for saving the troops wearied with continuous outpost service.

With regard to the action of the opponent, it must in the first place be recognized that his Intelligence Department was decidedly well managed. Moreover, the idea upon which the individual orders of General de Jouffroy were founded, of driving the enemy out of Troo and St. Quentin into the angle of the Loir at Montoire, by capturing the bridge of Les Roches and holding fast to the heights, was clearly correct, especially as the General assumed that the bridge of Montoire was not passable. But according to the first orders issued with this object in view, the action ought to have taken a

different course to that it actually followed. Thus General de Jouffroy, as has been already pointed out before, after he saw Boltenstern's Detachment immediately before him, probably caused his main forces to wheel to the right, so that the left wing reached to the Loir. By this means the retreat of Boltenstern's Detachment was even now still barred, although the crossing of Montoire was in possession of the Germans. This alteration in the execution of the first orders was undoubtedly judicious, and would have been crowned with success, if the troops disposed of had been able to resist the determined attack of the Germans.

Thus, on this day, once again the ever-guiding principle of the Prussian Army of facing death with boldness did not fail.

APPENDIX I.

ORDRE DE BATAILLE

Of the 3rd Infantry Division, 17th Army Corps, 2nd French Army of the Loir,
on the 27th December, 1870.

Commander: General of Division de Jouffroy.
Chief of the Staff: Chef d'Escadron de Mourlan.
Commander of Artillery: Chef de Batterie Serron.
Commandant of Engineers: Chef de Bataillon Pavillon.

1st Brigade.

Commander: Colonel Didier.

1st Battalion Chasseurs à pied.
45th Infantry Regiment de Marche.
70th Regiment Gardes Mobiles (Lot).

2nd Brigade.

Commander: Colonel Santereau.

46th Infantry Regiment de Marche.
78th Regiment Gardes Mobiles (Ain, Aude, Isère).

Artillery.

20th Battery of the 8th Regiment.

"	"	10th	"
21st	"	14th	"

Engineers.

1 section of the 4th Company of the 1st Regiment.
Attached—200 sabres of the Light Cavalry of the 17th Army Corps.

APPENDIX IIb.

Nominal List of Killed, Wounded, and Missing Officers, Officiating Officers, and Surgeons, on the 27th December, 1870.

Staff and Regiments.	Killed, or Died of Wounds.	Wounded.
3rd Hanoverian Regiment, No. 79.	2nd Lieutenant Krome	No. 1. Maj. Baron v. Stein- äcker. No. 2. 1st Lieut. Niemeyer. No. 3. 2nd Lieut. Buhlers. ¹ No. 4. Vice Sergeant-Major Gross. No. 5. Vice Sergeant-Major Ihssen. ¹ <i>Missing.</i> No. 1. 1st Lt. v. Witowski. No. 2. 2nd Lt. Wahnschaffe. No. 3. Vice Sergeant-Major Feukner. No. 4. Vice Sergeant-Major Fahrenholz. No. 5. Assist.-Surg. Püllen. No. 6. Assist.-Surgeon Kyll. <i>Missing.</i>
Sanitary Detachment No. 2	.. .. .	Assistant-Surgeon Müller.

¹ Both severely wounded, and fell into the enemy's hands.

